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HANDBOOK

OF THE

DIAGNOSIS AND TREATMENT

OF

DISEASES

OF THE

THROAT, NOSE AND NASO-PHARYNX.

BY

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THIRD EDITION,

THOROUGHLY REVISED AND GREATLY ENLARGED.

ILLUSTRATED WITH TWO LITHOGRAPHIC PLATES CONTAINING TEN FIGURES, AND ONE HUNDRED AND ONE WOOD ENGRAVINGS.

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PREFACE TO THIRD EDITION.

The favorable reception accorded to the first and second editions of this work has been exceedingly gratifying, and has encouraged me in the endeavor to make the third edition even more worthy of the commendation of the profession.

Numerous additions will be found throughout the book, among which may be mentioned an entirely new chapter on the physiology of the voice and articulate speech, and also a new chapter on vaso-motor coryza and hay fever. On the other hand, follicular and granular pharyngitis as well as pharyngitis sicca, have been omitted from the chapter on chronic pharyngitis for reasons given in the text.

The number of illustrations has been increased by the addition of twenty-four original engravings on wood, and by two carefully-executed colored plates, which I trust will prove of assistance to the student and practitioner.

*

I take this opportunity of expressing my gratitude to my friend, Dr. John Madison Taylor, and to his accomplished wife, who have greatly aided me by making the original drawings for most of the new illustrations.

CARL SEILER, M.D.

1346 SPRUCE STREET,
January, 1889.

PREFACE TO FIRST EDITION.

This little volume is intended to serve as a guide to students of laryngoscopy in acquiring the skill requisite to the successful diagnosis and treatment of diseases of the larynx and naso-pharynx. All purely theoretical considerations have therefore been omitted, and only points of practical importance have been discussed as concisely as possible, so that the work may be used as a ready book of reference on the subjects of which it treats.

Several affections, which are classed among systemic diseases, and merely exhibit severe laryngeal symptoms, such as scarlet fever, diphtheria, etc., have been omitted, since they do not strictly belong to maladies of the throat. The tables of symptoms to be found at the end of the volume are based upon carefully kept records of over one thousand cases treated by the author in private practice, and at the Dispensary of the

University Hospital, as well as in the German Throat Infirmary of Philadelphia.

I take this opportunity to express my thanks to Dr. J. Solis-Cohen for his aid, and for kindly permitting me to use some of the illustrations which embellish his book on Throat Diseases.

CARL SEILER, M.D.

PHILADELPHIA, May, 1879.

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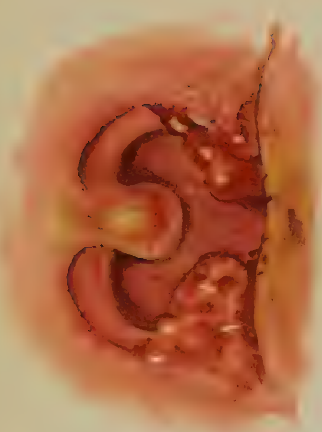

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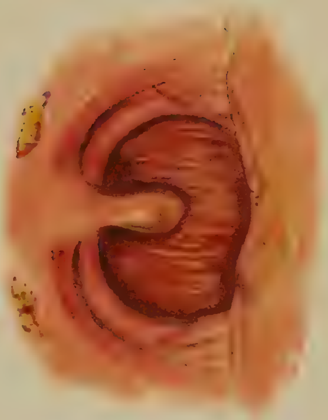

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DISEASES

OF THE

THROAT, NOSE, AND NASO-PHARYNX.

CHAPTER I.

THE LARYNGOSCOPE.

The laryngoscope is a combination of two mirrors so arranged as to enable the observer to see the interior of the larynx. The smaller of the two is plane, and is introduced into the back part of the mouth in such a manner as to be directly above the opening of the glottis, while the larger and usually concave mirror serves to reflect a strong light into the mouth and upon the small mirror. The latter in turn reflects the light downward, and thus illuminates the interior of the larynx so that its image can be seen on its surface.

History of the Laryngoscope.—In medical literature before the middle of the eighteenth century no mention is made of an instrument or apparatus resembling the laryngoscope, but recent excavations at Pompeii have brought to light small polished metal mirrors attached to slender handles which are supposed to have been used to inspect the cavities of

the human body. The first authenticated attempt at laryngoscopy and rhinoscopy was made by the distinguished French accoucheur M. Levret in the year 1743, who invented, among other surgical instruments, an apparatus by means of which polypoid growths in the cavities of the nose, throat, ear, etc., could be seen, and a ligature be passed around them for their removal.[1] This apparatus consisted mainly of a polished metal mirror which "reflected the luminous rays in the direction of the tumor," and on whose surface the image of the growth was seen to be reflected. The great value of this apparatus for the diagnosis and treatment of nasal and laryngeal diseases was, however, not recognized, and it shared the fate of many other valuable discoveries which were made before the world was ready to receive them: it was forgotten.

In 1807 a certain Dr. Bozzini, living in Frankfort on-the-Main, published a work describing an apparatus which he had invented for the illumination and examination of the cavities of the human body.[2] This apparatus consisted of a peculiarly shaped lamp and of a number of metal tubes, polished on their inner surface, of various shapes and sizes adapted for the different cavities of the body. The one intended for the examination of the larynx was bent near its end at a right angle, and had a mirror placed at the bend, which served to throw the light downward toward the opening of the larnyx when the

[1] Mercure de France, 1793, p. 2434.

[2] "Der Lichtleiter," Philipp Bozzini, Med. und Chir. Dr., Weimar, 1807.

tube was inserted into the mouth. When reflected light was to be used, the interior of the tube or speculum was divided into two portions by a longitudinal septum, and two mirrors were inserted at the bend—one for the reflection of the light downward, and the other for receiving the reflected image. This invention of Bozzini was treated, however, with derision by the medical profession, probably on account of the extravagant descriptions given of it in the papers, which were not verified by its performances.

In 1825, Cagniard de Latour, an investigator of the physiology of the voice, made some unsuccessful attempts to examine the living larynx.[1]

Senn, of Geneva, in 1827 endeavored to examine the larynx of a little girl suffering from an affection of the throat by means of a small mirror which he had made and which he inserted into the phranyx; but he failed to see the glottis, because, as he says, the mirror was too small, and because he used neither direct nor reflected light to illuminate the cavity below the mirror.[2]

In the year 1829, Benjamin Guy Babington published[3] an account of what he called the glottiscope, an apparatus which consisted mainly of two mirrors. One of these was small and attached to a slender stem, and was used to receive the image, while the other, an ordinary hand-glass, was used to reflect the rays of the sun or ordinary daylight upon the

1 Physiologie de la Voix, par Ed. Tournié, Paris, 1865.

2 Journal de Progrès des Sciences, etc., 1829.

3 Lond. Med. Gazette, 1829, vol. iii.

smaller mirror in the fauces. This combination was essentially the same as is used at the present day in the laryngoscope, with the difference that we now use artificial light in most instances, and a concave mirror instead of a plane one for reflecting the light.

While Babington was still engaged in perfecting his instruments, a mechanic named Selligue, who suffered from an affection of the throat, in 1832 invented a speculum for his physician, Bennati, of Paris, with which the latter was able, as he asserted,[1] to see the vocal cords. This instrument was similar to the one invented by Bozzini, and consisted of a double speculum bent at right angles and carrying two mirrors—one for illuminating the cavity, and the other for reflecting the image. Selligue was rewarded for his efforts by complete cure of his affection.

A number of others worked in the same direction, and endeavored to see the interior of the larynx in the living subject by employing different apparatus and methods of illumination. Thus, in 1838, Baumès, of Lyons, described a mirror the size of a two-franc piece ($1\frac{1}{8}$ inches in diameter) as useful in examining the larynx and posterior nares.[2] Then Liston in 1840 used a dentist's mirror,[3] and Warden, of Edinburgh, employed a prism of flint glass attached to a long stem as a laryngeal mirror.[4] In the latter part of the same year Avery, of London, employed a

[1] Recherches sur le Mécanisme de la Voix humane.

[2] Compte Rendu des Travaux de la Société de Médecine de Lyons, 1836–38.

[3] Practical Surgery, 1840.

[4] Lond. Med. Gazette, vol. xxiv. p. 256.

speculum with a mirror in its end for examining the larynx, using as an illuminator a concave reflector with a central opening, which was supported by a frame to be worn on the head of the operator.[1]

Up to this time all efforts at laryngoscopy had been made with a view to diagnose diseases of the larynx, with the exception of those made by Latour. In the year 1854, however, Signor Manuel Garcia, of London, without any knowledge of previous efforts, conceived the idea of studying the changes in the larynx during phonation in his own throat. For this purpose he placed a small dentist's mirror against the uvula and reflected the rays of the sun into his mouth and upon the small mirror by means of a hand-glass held in the other hand. By arranging his position in relation to the sun in such a manner that he could see the reflected image of the small mirror in his throat in the hand-glass, and in it the illuminated image of his larynx, after a few ineffectual attempts his efforts at auto-laryngoscopy were crowned with such success that he was enabled to study the movements of the vocal cords during phonation, and accurately describe the registers of the voice in a paper read before the Royal Society of London in 1855.[2] Although Garcia was the first who practised laryngoscopy successfully, his communication to the Royal Society attracted little attention, and would have been forgotten if it had not been that, in 1857, Türk, of Vienna, having heard of Garcia's paper, began to

[1] Med. Circ., June, 1862.

[2] Proc. Royal Society of London, vol. vii. No. 13, 1855.

use the laryngeal mirror on the patients in the K. K. Allgem. Krankenhaus for diagnostic purposes. At first he was not very successful in his attempts, and began to experiment with laryngeal mirrors of different sizes and shapes. While thus engaged Czermak borrowed Türk's mirrors, and modified them until he succeeded in the greater number of cases in seeing the vocal cords, using artificial light for illuminating the larynx. Meanwhile, Türk continued his experiments, and also succeeded in almost all cases of throat disease which came to his department of the hospital in seeing the interior of the larynx and in treating the lesions. Both Türk and Czermak improved their apparatus, and especially the latter, who by substituting artificial light for sunlight, and by inventing a number of different illuminating apparatuses, has given us the laryngoscope in the form in which it is used at the present day. It is but natural that Türk should have claimed priority in the successful use of this instrument, and in consequence of this claim a controversy was carried on for a number of years in the medical press between him and Czermak, which at times became quite spirited, but which left Czermak master of the field. In the winter of 1858–59, Madam E. Seiler, having heard of Czermak's experiments, had a laryngeal mirror constructed from his description, and practised laryngoscopy successfully on herself and others, among them the writer, with a view to study the physiology of the voice. Her efforts being crowned with success, she was able not only to verify Garcia's observations in regard to the

registers, but also discovered the so-called head register of the female voice, as well as two small cartilages in the vocal cords.

The Laryngeal Mirror.—The laryngeal mirror (Fig. 1) as it is used now consists of a small piece of silvered glass mounted in a metal frame, and attached to a wire stem at an angle of not less than 120°. This stem, about four inches in length and about one-tenth of an inch in thickness, should be soldered to the back of the mirror in such a way that the rim of the frame forms the angle with the stem, and should not be below it, as this would increase the diameter of the instrument without increasing its reflecting surface. The stem is made to slide into a hollow handle either of wood, ivory, or of vulcanite rubber, and is clamped at any desired length by a set screw. This arrangement is preferable to a fixed handle, inasmuch as the stem can be pushed entirely into the handle, thus economizing space and rendering the

FIG. 1.

Laryngeal mirror.

instrument more portable. The handle should be a little more than three inches long and about one-third of an inch in thickness.

Laryngeal mirrors of different shapes, square, oval, lozenge-shaped, etc., have been used by different observers, but it has been found that the circular form is the most easily borne by the patient, and can be used in the greatest number of cases. However, when hypertrophy of the tonsils exists, an oval mirror can be introduced between the protruding glands more easily than a round one.

Mirrors of polished steel, although they have a better reflecting surface than glass mirrors, are not to be recommended, because they are easily tarnished by the secretions of the mouth and pharynx, and are scratched in wiping them.

Sir Morell Mackenzie has also used total reflecting prisms mounted on handles like a laryngeal mirror, but has not found them to possess any advantage over glass mirrors.

The round glass mirrors vary in size from half an inch to an inch and a half in diameter, and are numbered by the instrument makers No. 1, 2, 3, 4, and so on. The size No. 3, a little more than three-quarters of an inch in diameter, is most serviceable in the greatest number of cases, but in examining patients it is advisable to have at least three different sizes at hand, say Nos. 1, 3, and 4.

Illumination.—In order to be able to see the laryngeal image in the small plane mirror, the larynx must be illuminated. This may be effected by throwing upon the laryngeal mirror when in position a strong light, which will be reflected downward into

the laryngeal cavity. For this purpose either direct or reflected artificial light or sunlight may be used. Direct illumination, by allowing a strong artificial light or sunlight to fall into the patient's mouth, although it is used by several of the eminent laryngologists of Europe, is both inconvenient and unsatisfactory, because the observer must either place his head in the path of the light in order to be able to see the surface of the laryngeal mirror, as in the case when sunlight is used, or he must place the lamp, candle, or other source of light between himself and the patient, which materially interferes with the freedom of his motions. For these reasons reflected light is now almost universally employed in laryngoscopy.

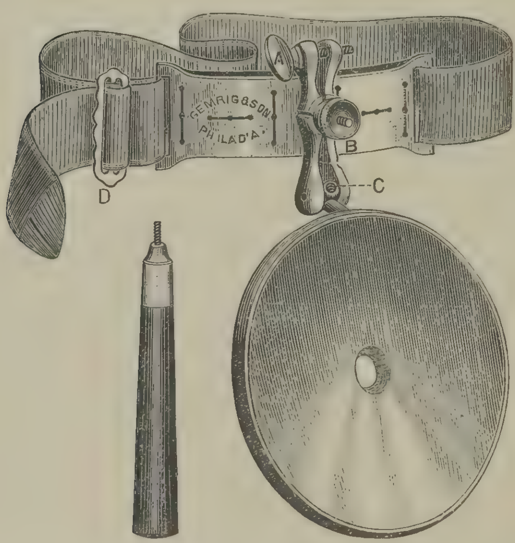
Reflected light may be obtained by throwing the light of a lamp, candle, gas-jet, or ordinary daylight into the mouth of the patient, by means of a circular, concave glass reflector.

Reflector.—This concave mirror should be from 3 to 4 inches in diameter, and should have a focus of from 10 to 14 inches; it should be silvered and not backed with amalgam. The metal frame in which it is set is attached, by means of a ball-and-socket joint, to some contrivance by which it can be supported on the observer's head, or be attached to the source of illumination if artifical light be used.

Semeleder recommends for this purpose a spectacle-frame to which the reflector is fastened. By means of the ball-and-socket joint the concave mirror can be brought before either eye, or can be fixed in the middle of the forehead between the eyes. This arrangement, however, will be found not only inse-

cure, but also very tiresome if the reflector has to be supported on the bridge of the nose for any length of time. A much better support for the reflector is the frontal band introduced by Cramer. This consists of a broad strap of some strong material, which passes around the head of the observer, and is fastened at the back by a buckle.

FIG. 2.



Head-reflector.

To the part of the band resting on the forehead is attached a padded plate, to which the reflector is fastened with its ball-and-socket joint. (Fig. 2.) Lately Mr. Ivan Fox, of Philadelphia, has introduced a head-mirror or reflector, which is very convenient on account of its portability. It consists of a jointed

steel band, which passes over the head from the forehead to the occiput, and which carries the reflector, mounted on a ball-and-socket joint, at its frontal end. This apparatus is, however, not as secure and comfortable as the Cramer head-mirror, and is therefore not adapted for long-continued use. If a condensing apparatus is used for concentration of light, the reflector is attached to it by a jointed arm.

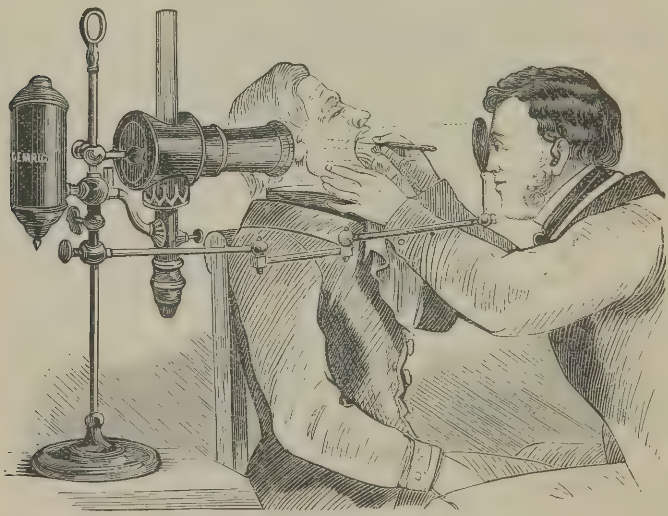
The reflector usually either has a small hole in the centre, or a small space in the centre is left unsilvered. This opening is intended to be brought before the pupil of one or the other eye of the observer in such manner that the line of vision and that of light have exactly the same direction. Using the reflector in this way like the reflector of the ophthalmoscope, it is easier to obtain an image of the larynx well illuminated, but with the great disadvantage of monocular vision, which makes all objects appear on the same plane, and prevents a correct interpretation of distances — a very important point in laryngoscopy. It will therefore be found more advantageous to place the reflector on the forehead, and from thence to reflect the light into the patient's larynx (Fig. 3). Both eyes may thus be employed in viewing the laryngeal image, and a correct idea of the relation of parts in regard to distances may be formed. The line drawn

FIG. 3.

Head-reflector in position.

from the pupil of the eye to the laryngeal mirror, and a line from the reflector upon the forehead to the mirror, do not form an angle sufficient to make any very great difference in the reflection of the light downward, and very little difficulty will be experienced in obtaining the desired image. The head-reflector should be concave when artificial light or ordinary daylight is used, but should be plane when

FIG. 4.



Tobold's illuminating apparatus.

direct sunlight is employed, for the concentration of the sun's rays by a concave reflector produces so much heat as to become painful to the patient.

Source of Light—As an artificial source of light a candle, coal-oil lamp, incandescent electric lamp, or gas flame suffices for ordinary purposes. But frequently it is desirable to have a much stronger light

than can be obtained in this manner, and several forms of apparatus for concentrating artificial light have been constructed and are in use.

The simplest of these is the so-called "Schuster Kugel," first recommended by Türk, and used especially for clinical purposes by Störk and others. It consists of a large spherical flask of glass filled with pure water, which is suspended in front of a lamp or gas-jet, and which concentrates the light very powerfully. The concentrated beam of light is then reflected from the head-reflector into the mouth of the patient.

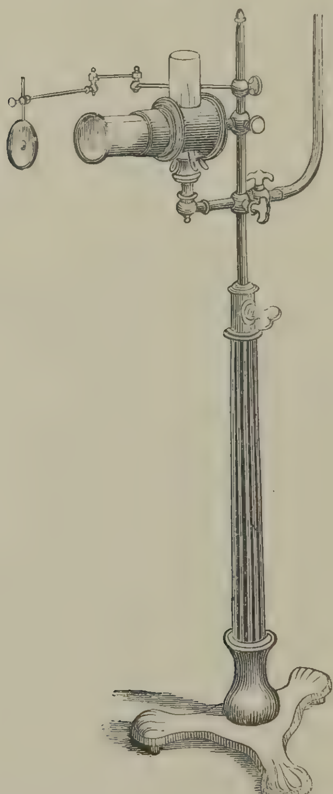
Tobold, of Berlin, constructed a more elegant light-concentrator for the laryngoscope, which is known as "Tobold's lamp." It consists of a brass tube containing several lenses, which are placed, one before the other, at such distances as to give the greatest possible amount of concentration of light. The back part of the tube is closed, while near the end two large holes are cut in its sides opposite to each other, through which the chimney of a lamp projects. The whole is fastened, by means of clamps, to a stand, to which is also attached a jointed arm bearing the reflector (Fig. 4). This apparatus is especially adapted for use in the office, where, unless disturbed, it can remain in the same place when not in use.

Dr. J. Solis Cohen has modified Tobold's apparatus by employing gas, and by inserting the rod which carries the concentrator and reflector in a metal stand, so that the light can be raised and lowered more easily to suit the different heights of patients. (Fig. 5.)

Sir Morell Mackenzie, of London, makes use of

an adjustable gas fixture, which is secured to the wall like an ordinary bracket-light. For a number of years I have used in my office a bracket similar

Fig. 5.

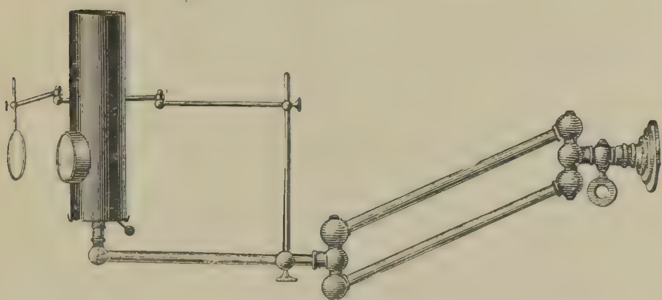


Cohen's modification of Tobold's lamp.

to Mackenzie's, made by the Harm, Brannen & Forsyth Manufacturing Company of Philadelphia, upon which the light-concentrator and reflector are mounted. (Fig. 6.) It has the advantage of being

easily moved with one hand into the proper position, and at the same time its joints are stiff enough

FIG. 6.



Seiler's gas bracket with Mackenzie's concentrator.

to support the weight of the light-concentrator and hold the bracket in any position without the use of a ratchet such as is used in Mackenzie's bracket, and which necessitates the use of both hands in changing its position. Mackenzie's light-concentrator—less complicated, more portable, and yet quite as efficient as Tobold's—consists of a cylinder of sheet iron, about 6 inches long by $2\frac{1}{2}$ in diameter. Near one end a hole is cut in the side of this cylinder, and a short piece of tube holding a condensing lens is attached to the edge of the hole. This lens, which is plano-convex, with a spherical curve, and of $2\frac{1}{2}$ inches diameter, is placed with the plane side toward the light. The height of the cylinder is to be so adjusted as to bring the centre of the lens opposite the centre of the flame. (See Fig. 6.)

This concentrator is intended to be slipped over the chimney of an Argand burner, but it can also be used in connection with a candle, lamp, or ordinary

gas flame, to which it can be fastened by spring clamps attached to the lower end of the cylinder. The concentrated light thus obtained is then reflected from the head-mirror, and can be thrown in any desired direction. The so-called lime-light, with its powerful and white illumination, can with advantage be used for laryngoscopy, and a number of laryngologists so employ it; but it requires some skill and experience to keep the light steady, and unless a large number of patients are to be examined in succession it will prove too expensive a luxury. The same holds good of the old electric-arc light in which the source of electricity was a battery, requiring constant attention, and the lamp with its carbon points was not only very expensive, but also was liable to get out of order. The best light, however, when the examinations are conducted in the office of the physician, is the electric incandescent light, which presents numerous advantages over the gas or oil lamp. It is more brilliant and whiter than any other suitable artificial light, giving off neither gases nor heat, nor does it consume the oxygen in the room; and since the introduction and perfection of dynamo-electric machines and of storage batteries it has become available and convenient for use in private houses. Numerous experiments which the author has carried on for some time have resulted in the application of this form of light for laryngoscopy in two ways which are both very satisfactory. The incandescent lamp is mounted upon the universal gas-bracket in place of the Argand burner, and either the Tobold lamp or Mackenzie's light-concentrator is slipped over it, so that it comes

opposite the centre of the lens. In fact, the electric lamp is substituted for the gas-burner, and the whole apparatus is used as described above.

The second method is to mount the electric lamp on the head-mirror in such a way that it projects a little from the surface and is a little to one side of

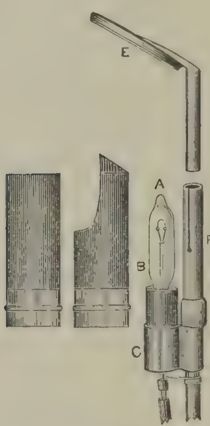
Fig. 7.

The Author's electric illuminator for the laryngoscope.

the centre of the reflector. (Fig. 7.) The light is then thrown forward in a cone, and can be directed with great ease into the mouth of the patient. Since the source of light moves with the mirror, the observer can follow the motions of the patient more easily; and if, in the first place, an easy position of

the head has been assumed when adjusting the light, much less fatigue is experienced by the examiner with this apparatus than when the light is reflected from a stationary source. Still another mode of using the incandescent lamp, which was suggested by Trouvé, is to mount the lamp within a tube one end of which is closed by a plano-convex lens, while the other end is covered by a metal cap carrying in its centre a ball-and-socket joint, by means of which it is fastened to the frontal plate of the head-band. In this way the light with its condensing apparatus is carried on the forehead like the head-mirror.

FIG. 8.



The S. S. White electric laryngoscope.

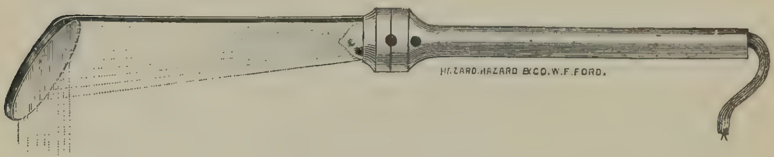
Still another mode of using the electric light for laryngoscopy was first suggested by Edison, and later, carried out and perfected by the S. S. White Dental Co. (Fig. 8.) It consists in attaching a very small incandescent lamp close to the laryngeal mir-

ror, mounted on a rather thick hollow stem which carries in its interior the conducting wires for the electric current which is supplied by a small battery carried in the pocket, and has on its surface a small button which when pressed down closes the circuit and lights the lamp. This apparatus is certainly very convenient if an examination of the throat is to be made at the patient's house and constitutes the ideal laryngoscope inasmuch as it combines the mirror and illuminator in one small instrument. Unfortunately, however, the light from the incandescent lamp besides being thrown downward into the laryngeal cavity is at the same time thrown into the observer's eye, thus preventing him from clearly seeing the reflected image, and the stem of the mirror must necessarily be so thick as to obstruct the view very materially. These defects make the instrument less useful in practice than it appears to be in theory.

Dr. Wm. C. Jarvis, of New York, devised an electric laryngoscope in which these objections are overcome in a great measure. It consists in a handle of wood or ebonite at one end of which a small incandescent lamp is mounted in such a manner that all the light from it is thrown forward while the laryngeal mirror is at some distance from the lamp, its stem being slipped into a hole in the lamp handle. (Fig. 9.) In this way the light is thrown upon the mirror and from it down into the larynx, while the lamp remains outside of the mouth of the patient; thus the heat developed by the light does not incovenience either the examiner or the patient, but there is still some of the light which falls directly into the observer's

eye and thus interferes with clear vision. Dr. Jarvis also uses an electric head-mirror similar to the one devised by the Author.

Fig. 9.



Jarvis's electric laryngoscope.

Sunlight is certainly the best source of light for the illumination of the interior of the larynx and nasal cavities; but, unfortunately, it is not available at all times and in all localities. When it can be obtained, however, the student should not neglect the opportunity, and should not be deterred from using it for examination by the little extra apparatus and trouble necessary.

The most convenient plan is to place a small plane mirror, such as a small toilet glass, mounted upon a stand in such a manner that it can be turned in any direction in the direct rays of the sun coming through a southern window. Then turn the mirror until the reflection falls upon a second plane mirror supported by a jointed arm and placed in a distant corner of the room, and in front of the chair upon which the patient is seated with his back toward the first mirror. The light from the second mirror is then thrown into the patient's mouth in the same manner as when a light-concentrator is used. In fact, the concave reflector of a Tobold's apparatus may be removed and a plane mirror substituted for

it. The second mirror may also be mounted on the head-band and used as a head-reflector, but this latter plan is not as satisfactory, because the reflected light from the first mirror is apt to strike the observer's eye and temporarily blind him.

Sunlight, as well as the light of the oxy-hydrogen and electric-arc lamps, is white, and therefore shows us the parts in their natural coloring, which is claimed as a very great advantage over all other sources of light.

It is true that the yellow rays which are predominant in all other artificial lights make the mucous membrane appear redder than it really is, and the observer may be led to believe that a congestion exists if the patient be examined by white light first and then by yellow light on different occasions. But as all our knowledge and appreciation of shades of color depend upon comparison with a standard, it makes no difference whether this standard, as in the case before us, be a littler redder when viewed by yellow light or not so red when viewed by white light. This advantage of the white light is, therefore, not of much practical value, and the expense and difficulties connected with the use of oxy-hydrogen or electric-arc light for laryngoscopy fully outweigh any advantage which can be claimed for it.

Czermak suggested another mode of illumination of the larynx, which he called "*illumination by transparency.*" It consists in concentrating strong sunlight upon the outside of the neck, thus filtering the light, so to speak, through the tissues until it reaches the interior of the larynx; but even under favorable circumstances, as when the neck of the patient is

thin and emaciated, only a very dimly lighted image of the larynx can be obtained by this means. And even if sufficient light could be passed through the tissues of the neck, the image would still be indistinct, because there would be no shadows. The light being filtered through the tissues emanates from all portions of the larynx, and the outlines of the different parts of the image would be swallowed up in the flood of red light, in the same manner as the outlines of the bones of the fingers are invisible if the hand be held between the eye and a strong light.

CHAPTER II.

THE ART OF LARYNGOSCOPY.

Before entering upon a description of the details of laryngoscopic examinations it will be necessary to understand the optical principle involved in the process. This principle is the law, *that the angle of reflection is equal to the angle of incidence.* Applying this law to our case we find that, in order to illuminate the interior of the larynx, we must place a reflecting surface above and behind the opening of the larynx at such an angle that the light received on this surface shall be reflected downward. (Fig. 10.) The rays forming the laryngeal image will then return in the usual way; that is, will be reflected from the same mirror to the eye of the observer. From this it will be seen that the nearer the head-reflector is placed

to the eye of the observer the better and the more easily will the image be seen.

It should always be borne in mind that the image seen in the mirror is a reflected one, like the image

FIG. 10.

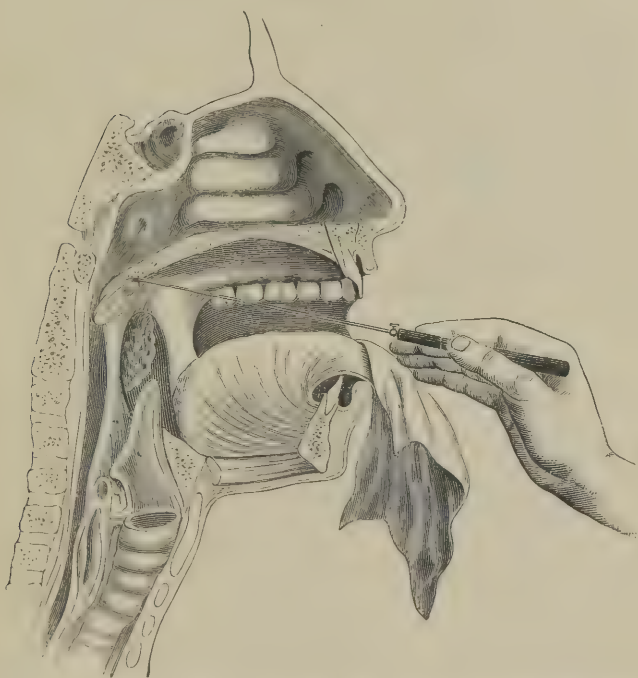
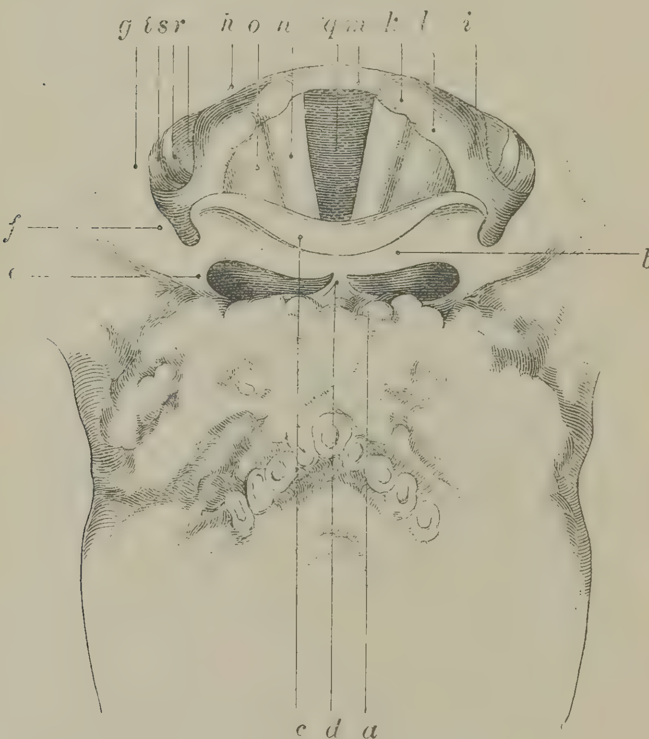


Diagram of section of head, showing the position of laryngeal mirror in the pharynx.

of one's self seen in a looking-glass. On account of the difference in height of the different parts forming the image, and because the mirror must be placed above and behind the opening of the larynx,

it appears reversed in an antero-posterior direction. Parts that are in front appear in the image to be behind, and *vice versâ*. (Fig. 11.) The same holds good when looking at a drawing of a laryngoscopic image.

FIG. 11.

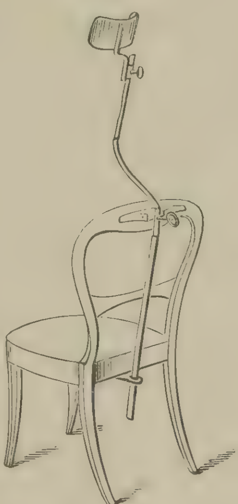


Laryngeal opening and back of tongue as seen from above in a transverse section of the head. (TÜRK.)

Position of Patient and Observer.—The relative positions of the observer, the patient, and the source of

light are of very great importance, especially for the beginner. The observer and patient should sit opposite each other, so that the eye of the former is about a foot from, and on a level with, the mouth of the latter, whose head should be slightly raised and inclined backward. In order to be in a comfortable position when near enough to the patient's mouth, the observer should either bring his knees to the left of the patient's, or else place one knee on either side. The latter plan is in many cases preferable, especially with children, because the practitioner can, to a certain extent, control the motions of his struggling patient by holding him with his knees. For office work it is most convenient to use piano-stools, which can be raised or lowered, for the seats both of the patient and the examiner, so that the difference in the height of different patients can be compensated for. The lamp or source of light should be placed to the right of and a little behind the patient, the centre of the flame being on a level with the patient's eye. (See Fig. 4.) When the laryngoscope is frequently used at the office of the practitioner it is of great advantage to have a head-rest, such as photographers use, attached to the chair occupied by the patient, so as to prevent any change of position of his head (Fig. 12).

Fig. 12.



Chair with head-rest.

When a piano-stool is used for the patient to sit on, the most comfortable and useful head-rest is an upholstered frame with an oval depression in its centre. This frame is hung on the wall against which the piano-stool is placed, at such a height that the back of the head of an ordinary sized individual sitting on the stool fits into the central portion of the oval depression.

The positions having been taken, the observer, by means of the reflector, then throws the light upon the patient's mouth, so that the circle of light is bounded above by the tip of the nose and below by the chin. If a reflector is used, which is attached to a light-concentrator (Fig. 6) by means of a jointed arm, no difficulty will be experienced in throwing the light in the desired direction. If, on the other hand, the head-reflector is employed, it is advisable to obtain an *easy position for the head and then to move the reflector on its universal joint until the circle of light falls upon the patient's mouth*, when the joint may be tightened, thus securing the reflector in the proper position. After this has been accomplished, the observer cannot turn his head without moving the light from the proper direction; but having first secured an easy and comfortable position for his head, he can readily assume it again, after having moved, and throw the light in the proper direction. If, on the other hand, the position of his head is a constrained one, it will be difficult, if not impossible, again to reflect the light into the patient's mouth. I should, therefore, advise all beginners to practise with the head-mirror until they are able quickly to reflect the light in any desired direction, as, for

instance, upon a spot on the wall, before attempting to examine a patient. They will thus save much annoyance to themselves, as well as to their patients, and will much more readily overcome the difficulties experienced by all beginners in laryngoscopy.

When the reflector has been properly adjusted, the patient is required to open his mouth as wide as possible, still inclining the head backward, so that the centre of the disk of light falls upon the base of the uvula, thus illuminating all surrounding parts.

Before introducing the laryngeal mirror, a careful inspection should be made of the parts displayed, and if the tongue should obstruct the view, by rising at its root, the patient should be required to pronounce the vowel sound of "Eh," which causes a rise of the velum palati and allows a view of the pharynx. In some cases it becomes necessary to depress the tongue by means of an instrument called the tongue-depressor, which will be described further on.

Introduction of the Laryngeal Mirror.—The pillars, tonsils, uvula, and pharyngeal walls having been examined, the laryngeal mirror, after having been warmed to prevent the condensation of moisture on its reflecting surface, is introduced in the following manner:

The handle is held between the thumb and forefinger of the right hand like a penholder, with the reflecting surface of the mirror looking downward. The hand is slightly flexed backward upon the wrist and is held a little below the mouth of the patient while the elbow is also flexed (Fig. 13). By a simultaneous unflexing of both the elbow and hand, and

a slight raising of the arm, the mirror is quickly carried into the mouth of the patient in a curved line, so that during this motion the reflecting surface of the mirror always remains parallel to the upper surface of the tongue without touching it or the palate, until its back touches or raises the uvula. Meanwhile, the left hand of the observer has grasped the end of the protruded tongue of the patient, and

Fig. 13.

Position of the hand and arm when introducing the laryngeal mirror.

holds it by means of a soft towel or napkin to prevent its slipping through the fingers. This holding of the tongue is necessary in order to increase the

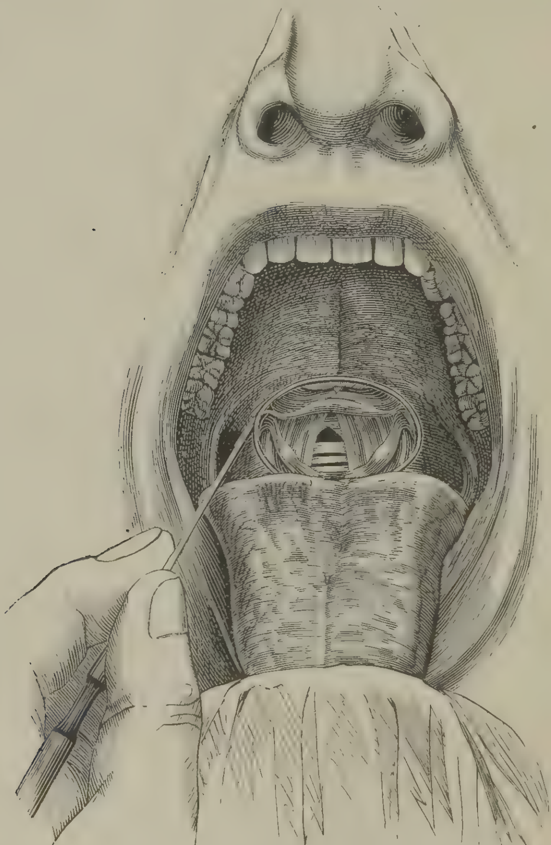
space in the pharnyx, and also to raise the larynx and bring its opening nearer to the mirror. Care should be taken not to allow the frænum of the tongue to come in contact with the edge of the lower teeth, and thus injuring it, as the patient will at once remonstrate against the holding of the tongue on account of the pain it produces. This can be avoided in the following manner: The napkin or towel should be laid over the outstretched thumb and index finger of the left hand, and a deep fold be pressed between them. The index finger is then laid with its back against the lower teeth of the patient, so that its upper surface is higher than the edge of the teeth and the tip of the protruded tongue dips into the fold of the napkin. The middle finger is then placed under the chin and the thumb on the tip of the tongue, thus holding it firmly between the index finger and the thumb. Finally the hand is slightly rotated away from the patient. The index finger which lies under the tongue acts as a roller upon which the tongue glides, and while the middle finger acts as the fulcrum for the lever which pulls upon the tongue, at the same time it prevents the head of the patient from coming too far forward. When holding the tongue in this way the observer has perfect control over the head of the patient, for any involuntary movement in any direction can be prevented.

In cases where it is necessary to make applications to the throat, the operator needs both his hands, and the patient should therefore be taught to make traction upon his tongue himself.

In the act of introducing the mirror great care

should be taken not to touch the tongue or palate, as this not only injures the reflecting surface of the

Fig. 14.



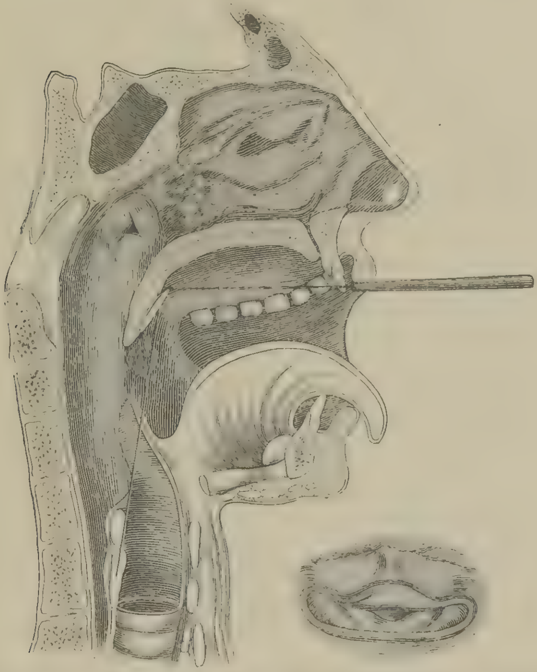
Laryngeal mirror in position, displaying the laryngeal image. (Cohen.)

mirror for the time, but also produces gagging, especially in persons not accustomed to laryngoscopic examinations. Greater immunity from this inconven-

ience is obtained by carrying the instrument quickly and steadily back until the desired point is reached.

The handle of the mirror is then brought to one side until it lies in the angle of the mouth; this movement brings the hand out of the line of vision.

FIG. 15.



Faulty position of laryngeal mirror with resultant laryngeal image.

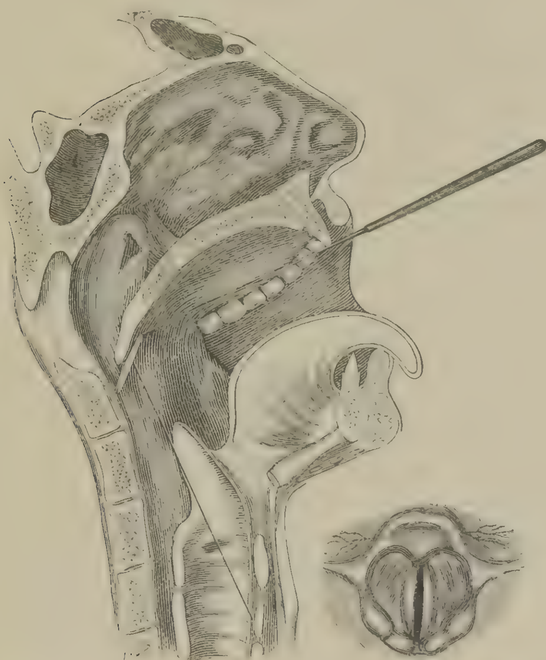
In this position it is advisable to steady the hand by resting one or two fingers against the cheek of the patient. If the mirror, lifting the uvula and resting with its lower rim against the posterior wall of the pharynx, is allowed to tremble, gagging or retching

immediately results, and prevents any further examination at that time.

When in position the mirror is slowly but steadily turned until the image of the larynx appears on its surface and can be examined (Fig. 14). The patient is required to say "Eh," in order to cause a rising of the epiglottis and to enable us to see the vocal cords in motion. The position of the mirror in the pharyngeal cavity is of the greatest importance, and unless its reflecting surface is placed at the proper angle only a portion of the laryngeal opening can be brought into view. If, for instance, the back of the mirror is placed against the velum so as to allow the uvula to protrude below the lower rim only the uvula itself, the back of the tongue, and the upper margin of the epiglottis are seen in the image. Again, if the mirror is simply placed with its lower margin against the wall of the pharynx carrying the uvula on its back, at a point level with the upper surface of the tongue (Fig. 15), only the back of the tongue, the epiglottis, and the arytenoid cartilages are brought into view. Only when the back of the mirror pushes the velum and uvula as high as possible into the upper portion of the pharyngeal cavity, can we expect to obtain a perfect image of all the details of the opening of the larynx (Fig. 16). As soon as there is any indication of gagging, the mirror should quickly be withdrawn, for if this is not done retching will follow, and not only cause a slight hyperæmia of the mucous membrane, but also make the throat so sensitive that a further examination becomes impossible. It is always better to introduce the mirror frequently and leave it in position but a short time than to wait until gagging sets in. It

is better in all cases to leave the mirror in the mouth but a short time and to introduce it frequently, thus studying the different parts of the image one after the other, than to attempt to see everything at once. In laryngoscopy, as in many other arts, not only the

FIG. 16.



Correct position of laryngeal mirror with resultant laryngeal image.

hand, but also the eye, must be educated to appreciate all the details and the variations from the normal. The throat, however, soon becomes very tolerant to the presence of the mirror when it is held still, and then the examination of the larynx can be

prolonged for a considerable time, and is often terminated only by the mirror becoming cool and moisture condensing on its surface. In order to obviate this difficulty, Dr. Henry Wright recommended, and actually employed a very ingenious plan for keeping the mirror at a uniform temperature. He attached to the back of the mirror an insulated spiral of thin platinum wire, which was connected with a small battery by means of thin copper wires running along the handle of the mirror. When the current is established, the electricity becomes concentrated in the spiral, and elevates its temperature and also that of the laryngeal mirror. It has recently been recommended to coat the mirror with glycerine, which would absorb the moisture; but this procedure materially interferes with the definition of the image, and has to be renewed every time the mirror is introduced. For all purposes it is best to warm the mirror slightly over the lamp, with the *glass* next to the flame so as not to injure the silver or amalgam backing by over-heating. Before introduction, the mirror should be placed against the back of the hand of the observer, in order to test its temperature, and prevent its being placed in position while too hot. Many laryngologists are in the habit of testing the temperature of the mirror by placing it against the cheek. This is, however, a dangerous practice, for a slight abrasion of the skin of the cheek escapes notice, and may be inoculated with syphilitic poison from a primary sore or mucous patch in the pharynx which has been touched with the mirror, while a scratch on the hand is seldom, if ever, overlooked, and thus

the danger of inoculation may be avoided. I am in the habit, before examining a contagious case, to hold my hands over a little dish containing a few drops of strong aqua ammonia in order to find whether there are any abrasions or cuts of the skin, for the ammonia vapor soon produces a smarting sensation wherever the skin is broken or abraded. I am thus enabled to find and protect such otherwise unperceived vulnerable spots.

Obstacles to Laryngoscopy.—The difficulties attend ing laryngoscopy, and the obstacles which prevent a good view of the larynx, must be considered under two heads: 1st. Those that are produced by the examiner himself, which have already been alluded to. They consist principally in a faulty position of the mirror in the pharyngeal cavity, an irritation of the fauces due to the trembling of the mirror when in position, the touching of the back of the tongue or palate while introducing the mirror, pulling the tongue out too forcibly so as to give rise to pain, and, finally, the want of proper adjustment of the light, without which the larynx cannot be illuminated, even though the laryngeal mirror is in the proper position.

2d. Obstacles presented by the patient. They are dependent upon undue irritability or peculiar formation of certain parts of the throat.

Undue irritability of the fauces is of rare occurrence and is usually confined to the posterior wall of the pharynx. In most cases want of steadiness of the mirror is the exciting cause. It may be overcome by holding the mirror so that its lower rim does not touch the pharynx; by letting the

patient drink a glass of ice-water immediately before the mirror is introduced, the cold producing local anæsthesia for a short time; or by employing some anæsthetic, such as a four per cent. solution of cocaine, ether, or chloroform, thrown into the fauces by means of an atomizer. Painting the fauces with a strong solution of potassium bromide has been recommended, but I have not found it as reliable as I was led to believe. The surest means of overcoming this irritability is practice on the part of the patient, thus causing the parts to become accustomed to the presence of a foreign body. This consists in frequent introductions of the mirror, even without the anticipation of seeing anything on the part of observer, or by directing the patient to introduce a teaspoon as far back into his throat as possible. If the patient is willing to do this before a looking-glass three or four times a day, he will in a very short time be able to bear the mirror for a considerable time when held firmly without trembling. The greatest difficulty, however, experienced by the beginner, is caused by a rising of the back of the tongue at the approach of the mirror, in spite of the traction made at its tip. In such cases, which are rather frequent, the tongue should be depressed with the tongue-depressor, not *forcibly*, but by slight long-continued pressure, which tires the muscles of the tongue and causes the organ to subside to a level with the lower teeth. If force be used, the tongue will slip from under the blade of the instrument and rise higher than before. This may recur repeatedly, until both the patient and the hand of the observer are tired out by futile efforts.

The *tongue-depressor* in the simplest form in which it is daily used by the general practitioner for examining the fauces is the handle of a spoon. For laryngoscopic purposes, the spoon is, however, not to be recommended, because the hand holding it must be on a level with the mouth, thus obstructing the view and light. An instrument therefore has been constructed which obviates this difficulty. It consists of a leaf-shaped blade of silver or German silver, bent at right angles and inserted into a flat wooden handle. The lower surface of the blade is slightly concave, and ribbed so as to take a better hold of the slippery back of the tongue, and from the bend is about three inches in length. It is introduced into the mouth as far back as possible, and pressed upon the back of the tongue, while the hand of the examiner is below the chin of the patient. For the sake of convenience in carrying the instrument, the blade has been so hinged to the handle that it will fold up against the latter, and will open at a right angle with it. A more elegant and lighter instrument of the same description has lately been introduced in which the handle is also made of metal, and, like the blade, is heavily nickel plated, and which, when folded, can be carried in a pocket-case (Fig. 17). Soon, however, the metal tongue-depressor becomes tarnished by the secretions of the mouth or by the substances used for applications to the throat, and then presents an appearance disgusting to many patients, who will not, on that account, submit to its use. For the sake of greater cleanliness, Dr. J. Solis Cohen devised a tongue-depressor made of hard rubber; this is known as

Cohen's tongue-depressor (Fig. 18). It consists of a piece of ebonite bent upon itself, either end being a

Fig. 17.

Folding tongue-depressor.

Fig. 18.

Cohen's tongue-depressor.

little over three inches long. The bend being more than at right angles, the hand holding the instrument rests underneath the chin of the patient; but, if a different curve be desired for any particular case, it can easily be obtained by placing the instrument for a little while in hot water. When soft it can be bent into any shape, which it will retain when cooled by immersion in cold water.

Enlarged tonsils sometimes prevent the introduction of a round mirror into the fauces, while an oval one may be slipped between the projecting glands.

The most serious obstacle is a too large or a pendent epiglottis, which completely shuts out the view of the interior of the larynx. By letting the patient sing in a very high key, or making him laugh, we

can frequently get a glimpse of his glottis. There are cases, however, fortunately not very common, where this is of no avail. Several observers have devised instruments for the purpose of holding the epiglottis forward while the mirror is in position. They are long, slender, slightly bent forceps, the shanks of which are crossed so that the ends are closed, instead of opened, by the springs. The ends are furnished with sharp points, which, when the forceps is applied, penetrate the mucous membrane, and thus prevent slipping (Fig. 19). This is unnecessary, since forceps whose spring is sufficiently strong, and whose ends are well roughened, will hold the epiglottis without slipping. Several German laryngoscopists, in operations at the anterior angle of the glottis, have drawn a silk thread through the body of the epiglottis and held it up by pulling upon the ends hanging out of the mouth. They assert that no evil consequences have followed this procedure, and that the amount of pain caused by transfixing the epiglottis is scarcely worth mentioning. A better plan, however, is to attach to the epiglottis a so-called bull-nosed

FIG. 19.

Elsberg's sponge-holder and epiglottis forceps.

forceps, such as is used for the compression of arteries in surgical operations, with a string and small weight tied to it. The weight hanging out of the mouth of the patient makes traction upon the string and forceps, thus elevating the epiglottis. In most cases, at least the arytenoid cartilages can be seen without artificially elevating the epiglottis, and from them a great deal of information as to the movements of the cords and the condition of the mucous membrane can be obtained.

Auto-laryngoscopy.—The first successful attempts at laryngoscopy were made by Garcia on himself. He observed the action of his own larynx in singing. Since then auto-laryngoscopy has been frequently resorted to in order to obtain the necessary skill for manipulations necessary in laryngoscopy, for the hand is guided not only by the eye of the observer but also by the sense of touch in his throat, thus enabling him to detect and correct a false motion much more quickly.

The instruments needed for this method of examining the larynx are the same as are used for the examination of the larynx in others, with the addition of a plane mirror, in which the image of the larynx reflected from the laryngeal mirror is seen. A short description of the procedure and of the position of the instruments will enable any one to practise auto-laryngoscopy.

The observer, having seated himself in a chair, with or without a head-rest, places in front of himself a lamp, at such a height that the centre of the flame is on a level with his mouth when the head is slightly raised and inclined backward. Immediately

below the flame a small plane mirror, about four inches square, is fastened to the lamp, or, better still, is mounted on a separate stand and placed to the right of and a little above the flame. If a concave reflector is to be used to throw the light into the throat, the lamp is placed a little behind and on the right side of the observer's head, so that the light does not shine directly into his eyes and thus interfere with distinct vision. The reflector, mounted on a stand high enough to be on a level with the mouth and movable in all directions, is placed in front of the observer, and alongside of it the plane mirror. If sunlight can be obtained, the reflector can be dispensed with, and the plane mirror used to throw the light into the fauces, the observer seating himself with his back to a southern window and allowing the sun to shine on the plane mirror.

When all is ready, the laryngeal mirror having been warmed, the observer opens his mouth, pulls out his tongue with his left hand protected by a towel or napkin, and introduces the mirror quickly into the fauces, observing and guiding his motions by the image reflected from the plane mirror. Upon emitting a sound, and at the same time rotating the mirror in the fauces until the laryngeal image appears on its reflecting surface, he can study the motions of his own larynx during vocalization, or quiet breathing, by the reflection of its image in the plane mirror before him.

The same precautions to prevent gagging have to be observed in auto-laryngoscopy as are necessary in examining a patient, and for this reason the beginner should commence by examining his own larynx, for

then he will learn by his own and often painful experience how to overcome the obstacles to laryngoscopy much sooner than he would by practising first on others.

Infra-glottic Laryngoscopy.—In some cases where tracheotomy has been performed, and the canula is fenestrated, the larynx can be seen from below by introducing a very small mirror through the tube with its reflecting surface turned upward. Of course, the image obtained in this way is an entirely different one from the ordinary image of the larynx as seen from above, and hardly anything else than the vocal cords, which on their under side are reddish and not pearl-white as on their upper surface, is noticed.

Only in cases where the larynx cannot be seen from above, on account of cicatrization of the epiglottis tying this organ down, or in cases of tumors extending below the glottis, is this method, which was called by Mackenzie "infra-glottic laryngoscopy," of any diagnostic value.

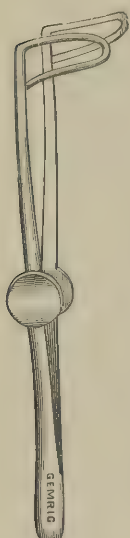
Rhinoscopy.

Rhinoscopy is the art of inspecting the nasal cavities, and may be divided into anterior rhinoscopy or the examination of the anterior nares through the nostrils, and into posterior rhinoscopy or the inspection of the vault of the pharynx and the posterior nares from behind.

The anterior nares may in many cases be examined in the following manner with a simple bent probe. A strong light being thrown upon the patient's face, and the head inclined backward until

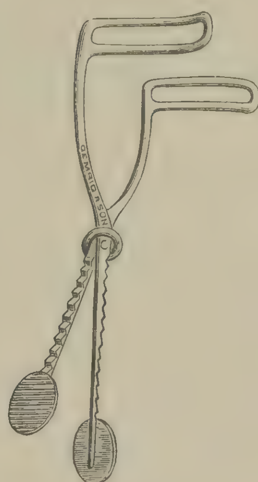
the nose is on a level with the examiner's eye, the latter rests the fingers of one hand upon the forehead of the patient, and elevates the tip of the nose with his thumb. With the probe introduced into the nostril he separates the ala from the septum with the other hand, thus opening the nostril sufficiently to illuminate the anterior nasal cavity on that side up to a considerable distance, and to examine the condition of its lining mucous membrane.

Fig. 20.



Bosworth's nasal dilator.

Fig. 21.



Jarvis's self-retaining nasal dilator.

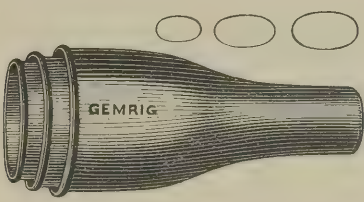
The opening of the nostril may, however, be effected more thoroughly by means of an instrument called a nasal dilator, of which there is an endless variety in the market, and among them I have found Bosworth's and Jarvis's self-retaining dilators (Figs. 20

and 21) to be the most satisfactory. The blades of these instruments are introduced into the nostril and being separated by the spring, dilate the nostril sufficiently to allow the inspection of the anterior nasal cavity, and to make room for the introduction of instruments high up into the nose. This forcible separation of the soft parts from the septum, which is effected by these instruments, is, however, a great disadvantage for diagnostic purposes, because by it the parts are distorted and disturbed in their relation to each other, so that it is impossible to form a correct estimate of the condition of the parts, as regards proximity to each other when the nostril is not dilated. If for instance an obstruction, caused by hypertrophy or swelling of the tissue at the anterior extremity of the lower turbinated bone, exists, as is so frequently the case in nasal catarrh, this will escape notice, because the obstruction is temporarily removed through the forcible separation of the parts by the blades of the dilator.

For this reason and for others which will be apparent later on, I prefer a rubber nasal speculum, for examining the anterior nasal cavities, which closely resembles the ear-speculum in common use, except that it is somewhat larger and has an oval opening instead of a round one at the narrow end (Fig. 22). Three sizes fitting into each other, and forming what is called a nest, are manufactured and are all that is necessary for most cases. They should be made of hard rubber and their inner surface not very highly polished, while the edge of the smaller opening should be rounded off so as to prevent injury to the mucous membrane. The metal specula

with a highly polished or white inner surface, which are sold by instrument makers, are not satisfactory because they are more disagreeable to the patient, are apt to become tarnished by the secretions or the solutions used in treating nasal diseases, and the internal reflection from the inner bright surface by dazzling the eye materially interferes with distinct vision of details in the cavity beyond.

Fig. 22.



Nest of rubber nasal specula.

In making an examination the speculum is introduced with a slight rotatory motion into the nostril until its end has passed the margin of the vestibule, the ridge or constriction in the nostril where the skin joins the mucous membrane. Care should be taken not to scratch the mucous membrane of the septum with the edge of the speculum, as this not only gives rise to pain but also frequently to hemorrhage which makes a further inspection of the anterior nasal cavity impossible for the time being. It is, therefore, best to direct the narrow end of the speculum toward the ala of the nose while introducing it until the edge of the vestibule is passed, when the instrument can be brought into the straight position. A strong light from the stationary or head-reflector

is then thrown through the speculum into the cavity, when, by moving the speculum up and down, the different portions of the cavity may readily be examined in succession. The head of the patient also should be moved while inspecting his anterior nasal cavities, so that the light can be thrown up when the head is inclined backward, or down along the floor of the nose when inclined forward. When accumulations of secretion obstruct the view, they should be removed by washing out the cavity with an alkaline solution thrown in with an atomizer, and any changes in the bulk of the different portions should be examined as to their consistency by touching them with a probe bent at an angle to the handle, and introduced through the speculum.

Posterior Rhinoscopy.—Posterior rhinoscopy is much more difficult than laryngoscopy or anterior rhinoscopy, and requires more patience and dexterity on the part of the examiner than either of the former, because but very few persons have control over the movements of the velum palati, and in most of these the upper portion of the pharyngeal wall is so sensitive that the slightest touch with an instrument gives rise to reflex cough and to gagging. In many cases, however, with patience and skill the naso-pharyngeal cavity and the posterior portion of the nasal cavities can be illuminated and inspected. This is accomplished by the same instruments and appliances used in laryngoscopy, namely, a small plane mirror, and a strong light thrown into the fauces by means of a reflector.

Unlike as in laryngoscopy, the head of the patient should not be inclined backward, the tongue should remain passively on the floor of the mouth, and be

held down with a tongue-depressor, so as to increase the space in the fauces as much as possible. With

Fig. 23.

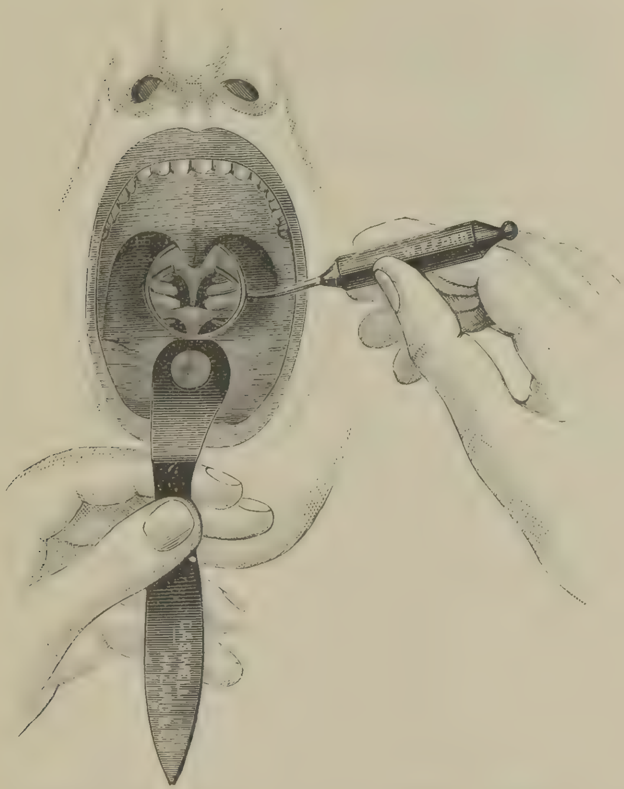


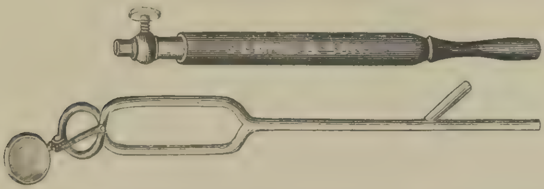
Diagram showing rhinoscopic mirror in position. (Bosworth.)

children the author has found the forefinger of the left hand to be the best means of depressing the tongue, for the little patients, as a rule, have a horror of the formidable-looking instrument. The mirror having been warmed, is then introduced into the

pharyngeal cavity behind the velum palati with its reflecting surface turned upward, and by manipulating, it is caused to reflect the light from the reflector upward and forward so as to illuminate the vault of the pharynx and the posterior nares (Fig. 23). An experienced manipulator can use a mirror of considerable size, and the larger the better; but a beginner should not attempt to introduce a mirror larger than one-half inch in diameter. The stem of the mirror should be slightly curved, with the convexity of the curve pointing upward, as this facilitates the introduction of the mirror, and enables the observer to obtain the proper angle for the mirror more easily. In laryngoscopy it is necessary that the mirror should be attached to the stem at a fixed angle (120 degrees), but in posterior rhinoscopy the angle should be different in different cases, because of the individual differences found in the distance from the vault of the pharynx to the base of the tongue, and from the posterior walls of the pharynx to the posterior nares. It is therefore of great advantage to be able to change the angle of the mirror, and thus adapt it to the requirements of the case. This may be done with Jarvis's rhinoscopic mirror and tongue-depressor (Fig. 24) as modified by myself. The instrument consists of a stout wire which, after having been forked or divided at some distance from its insertion into the handle, forms the loop for the tongue-depressor. The two branches then cross each other, and are bent to form another loop at an angle to the larger one. The ends of the wire are somewhat flattened and press against each other, thus closing the smaller loop and forming a sort of pincette, which can be opened by

pressing the sides of the larger loop toward each other. The ends of the pincette are perforated by a

FIG. 24.



Seiler's modified Jarvis's rhinoscopic mirror and tongue-depressor.

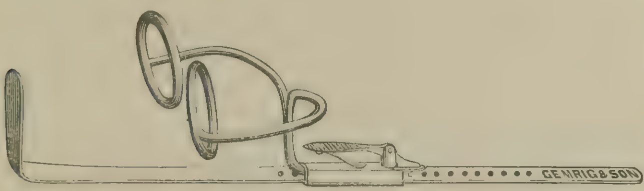
small hole which receives a pin attached at right angles to the short shaft of a small mirror, thus forming a hinge so that the mirror can be placed at any desired angle with the handle or stem. The spring of the pincette cannot, however, be made strong enough to prevent a change of the angle of the mirror by coming in contact with the pharyngeal wall, and I therefore had a ratchet placed at the shaft of the mirror where it is hinged to the ends of the pincette, and a small steel spring coming from one of the branches of wire where they cross each other to form the small loop, by engaging in the teeth of the ratchet, holds the mirror at the angle given to it before introducing. The large loop acts as a tongue-depressor, so that with this admirable instrument the examination of the post-nasal cavity can be made with one hand, leaving the other free for the manipulation of other instruments. In order to be able to exert more pressure upon the tongue and to bring the hand out of the line of vision, the handle may be attached to the stem at an angle like the one in the folding tongue-depressor.

Having introduced the mirror into the pharynx behind the velum, it will be found that in most cases the palate will rise forcibly, thus completely obstructing the view and preventing the introduction of the mirror into the pharyngeal cavity. This difficulty can be obviated by telling the patient to breathe through his nose, at the same time keeping the mouth open. After a little practice he will learn to do so, when the velum will drop and the mirror can be brought behind it, illuminating the vault of the pharynx and the posterior nares. Under no circumstances should the rim of the mirror touch the posterior wall of the pharynx, as otherwise the palate will at once rise and obstruct the view. In order to prevent this great and chief obstacle to posterior rhinoscopy, a number of instruments have been devised to hold the velum forward and out of the way, but none of these so-called palate retractors has proved advantageous in my hands, and I have found that practice on the part of the patient, and a diminution of the irritability of the parts by local applications, will accomplish the purpose much better than any instrument could do.

In the case of operations in the post-nasal cavity, however, it is not only desirable but often absolutely necessary that the operator should be able to watch his instrument in the rhinoscopic mirror; then it becomes necessary to prevent a rising of the soft palate by mechanical means. This may be accomplished by inserting a blunt hook behind the velum and drawing it forward, so as to increase the naso-pharyngeal space. A hook of this kind may be improvised, but it has the disadvantage of not being self-retaining, and must be held by an assistant.

Dr. Porcher, of Charleston, has devised an admirable instrument for this purpose, which meets all the requirements in most cases (Fig. 25). It consists

Fig. 25.



of an ordinary palate hook upon the stem of which a slide attachment has been added. From the front of this slide project two arms, which end in two medium-sized rings, and at its rear is an automatic spring-catch, which penetrates the perforated stems at short intervals. When in position the two rings of the arms rest on either side of the nose, just above the alveolar processes, and are easily retained there by the counter-pressure of the retracted palate. In some cases this instrument is, however, not sufficient to keep the palate out of the way, and then the method devised by Dr. Jarvis must be employed. This is as follows:

An Eustachian catheter is first introduced along the floor of the nose until its curved end has passed into the pharyngeal cavity. Through this a piece of catgut of about the thickness of a "D" string used on violins is passed until its end appears in the pharynx below the margin of the palate, where it is grasped by a pair of forceps and drawn out through the mouth, the other end of the string still projecting from the nostril. The catheter is then

withdrawn and a piece of narrow elastic tape, such as is found in every trimming store, is tied to the end of the string projecting from the mouth, and is drawn into the pharynx and out of the nose by the withdrawal of the catgut string, so that one of its ends projects from the mouth and the other from the nose, thus making a loop around the soft palate. Another piece of elastic tape is then, in the same manner, passed through the other nostril and the end secured by Jarvis's tape-holder. These are two small V-shaped spring clips so arranged that the tape passing through apertures is caught by a tooth-like projection and firmly held. Pressure on the blades of the clip releases the catch and sets the tape free.

The end of the tape projecting from the mouth of the patient is passed through the slit of the blade of the tape-holder to which the cross-bar or catch is fastened, and knotted to prevent its slipping out. The other end is passed through the slit of the other blade and also through the slit of the catch, which can readily be done by slightly compressing the blades of the tape-holder until the two openings come opposite to each other. The pressure being taken off, the cross-bar draws the tape down upon the blade of the instrument and firmly holds it there, thus preventing its slipping when sufficient traction has been made to draw the palate forward. The strain of the two tapes passing around the velum can be conveniently regulated and nicely balanced, thus making their presence tolerable, and should efforts at gagging or vomiting show themselves, the elastic tapes can quickly be relaxed, giving the velum free play.

CHAPTER III.

ANATOMY AND THE NORMAL LARYNGEAL AND RHINOSCOPIC IMAGES.

Although the scope of this little manual is not sufficiently extended to enter at length into the consideration of the anatomy of the larynx and the pharyngeal and nasal cavities, yet it will be convenient, in a few words, to describe the anatomical relation of those parts to each other which form the laryngeal and the rhinoscopic images, before describing these latter when seen on the reflecting surface of the mirror.

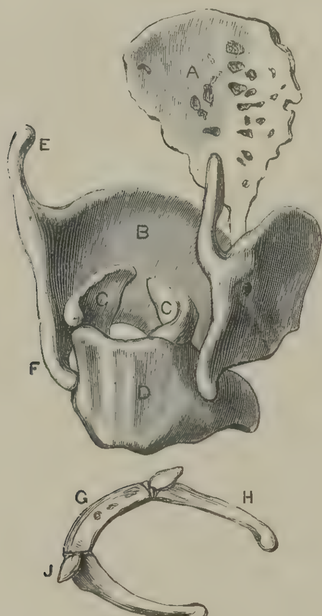
The anatomy of the larynx and trachea, as well as of the nasal cavities, is so well understood and described by authors of text-books on general anatomy and physiology, that a very few sentences will suffice to refresh the reader's memory.

Anatomy of the Larynx.

The larynx is a funnel-shaped expansion of the trachea situated at the upper part of the air-passages. Its lower narrow part is circular, while its upper expansion presents a triangular appearance. It consists mainly of nine cartilages—three single and three in pairs—which are held together by ligaments, and are moved upon each other by numerous small muscles. The interior of this cartilaginous tube is lined with mucous membrane, which is thrown into

two pairs of folds and is covered with ciliated epithelium, except at the lower folds, the vocal cords, which are covered with tessellated epithelium. In examining the cartilaginous skeleton of the larynx (Fig. 26) the first object which attracts our attention

FIG. 26.



Hyoid bone and the laryngeal cartilages. (ELLIS.)

G. Body of the hyoid bone. H. Large cornu. J. Small cornu. A. Epiglottis. B. Thyroid cartilage. C. Arytenoid cartilage. D. Cricoid cartilage. E. Upper cornu, and F. Lower cornu of the thyroid cartilage.

is a large and peculiarly shaped cartilage—the thyroid cartilage.

The *thyroid cartilage*, so called from its resemblance to an old Etruscan shield (θυρεός), is composed

of three pieces—two lateral wings or alæ, and a centre-piece. Each wing is quadrilateral in shape, and is united to its fellow by the centre-piece at an acute angle, which, being covered only by skin, forms the projection in the anterior portion of the neck called the pomum Adami; more prominent in the male than in the female on account of the greater amount of adipose tissue overlying it as well as on account of the fact that the angle formed by the junction of the two lateral wings of the thyroid is less acute in the female than in the male.

The upper margin of the wings is deeply notched immediately above the greatest anterior projection of the pomum Adami, rising and falling as we trace it from before backward, so that it presents an S-shaped outline. The lower margin is less complicated, having for its outline a simple curve from before backward.

The posterior border being rather thick and rounded, presents a wavy outline in a perpendicular direction, and terminates above in the superior cornu and below in the inferior cornu of the thyroid cartilage.

The outer surface of the alæ presents a roughened oblique ridge, which passes downward and forward, originating in a tubercular projection at the root of the superior cornu. The inner surface is smooth and is covered by mucous membrane.

The centre-piece, which was first described by Luschka, can only be seen by removing the perichondrium covering the cartilage. Its shape is that of a bottle, or pyramid, with its base downward. It is situated at the junction of the wings and forms the keystone to the arch of the whole cartilage. Its

color is slightly different from that of the two wings, being a shade more yellow, and a microscopic examination reveals the fact that it is composed of *fibrous* cartilage, while the wings and other cartilages of the larynx are of the *hyaline* type.

Cricoid Cartilage.—The thyroid cartilage is mounted upon the *cricoid cartilage*, which latter forms the lower expansion of the larynx. It has received its name from its striking resemblance to an old-fashioned signet-ring (κρίκος), the posterior part being broad and thick forms the crest-plate, while the anterior part is thin and narrow and forms the ring part. On the posterior plate we observe a ridge in the median line, which serves for the attachment of the *crico-arytenoideus posticus* muscle.

The superior border of the cricoid cartilage is directed upward and backward, owing to the great width of the posterior plate. It has a smooth and very slightly wavy outline, and is notched at the middle of the plate. On either side of this notch we observe a smooth oval surface which serves for the articulation with the arytenoid cartilages. The lower border is horizontal and also wavy, and is connected with the first ring of the trachea.

The Arytenoid Cartilages, so called from the resemblance they bear when approximated to the mouth of a pitcher (ἀρύταινα), are two small, irregular, pyramidal cartilages, which are mounted upon and articulated with the upper posterior margin of the cricoid cartilage. The posterior surface is smooth, triangular, and is bent backward. The anterior surface is convex and roughened, and to it the thyro-arytenoid muscle is attached. The internal surface is smooth and very narrow, concave, and

covered with mucous membrane. The base is concave and smooth, articulated with the cricoid cartilage, and presents two projections or processes in its margin. The anterior process serves for the attachment of the vocal cords, and is called the vocal process, to which in the female larynx is attached a small elongated piece of fibrous cartilage embedded in the cord, called the *cartilage of Seiler*, while the external process, which is shorter and more rounded than the vocal process, serves for the attachment of several muscles, and is called the muscular process.

The apex of the arytenoid cartilage is elongated and curved backward and inward. It is surmounted by a small nodule of cartilage, the *cartilage of Santorini.* Two small elongated cartilages are also placed in the ary-epiglottic fold.

Beside the cartilage already described, we find a thin lamella of fibrous cartilage inserted into the angle of the thyroid cartilage. This thin spoon-shaped cartilage, the *epiglottis*, serves to close the opening of the air-passages in deglutition. It is broad on its free end and narrow at the point of insertion, concave in its laryngeal surface and convex in its glossal surface.

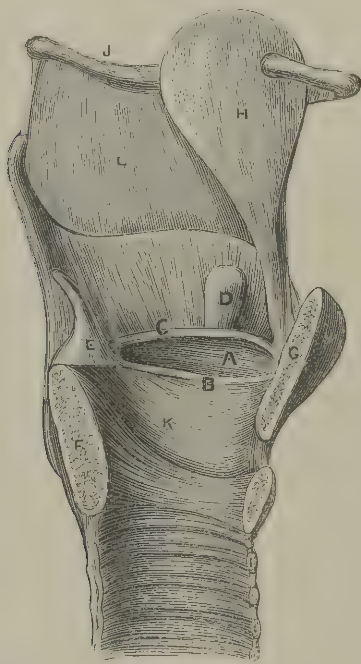
The hyoid bone, although intimately connected with the larynx, does not belong to its cartilaginous skeleton.

Ligaments.—The cartilages of the larynx are connected by ligaments among themselves (intrinsic), and to other structures (extrinsic). (Fig. 27.)

The largest of these is the *thyro-hyoid membrane*, a broad fibro-elastic membrane attached below to the upper border of the thyroid cartilage, and above to the upper margin of the posterior surface of the

hyoid bone, being separated from the latter by a synovial bursa. It is somewhat thicker in the middle than at either side, and is penetrated by both vessels and nerves.

Fig. 27.



Vocal apparatus, on a vertical section of the larynx. (Ellis.)

A. Ventricle of the larynx. B. Vocal cord. C. Ventricular band. D. Sacculus laryngis. E. Arytenoid cartilage. F. Cricoid cartilage. G. Thyroid cartilage. H. Epiglottis. K. Crico-thyroid ligament. L. Thyro-hyoid ligament.

Between the greater cornua of the hyoid bone and the superior cornua of the thyroid cartilage we find two round elastic cords, strengthened by a

small cartilaginous nodule, which are called the lateral thyro-hyoid ligaments.

Connecting the cricoid and thyroid cartilages is a triangular membrane of yellow elastic tissue. It is thick in front, where it connects the upper border of the cricoid cartilage to the lower margin of the thyroid, and thin on either side, where it has its upper insertion on the inner surface of the thyroid cartilage below the true vocal cords.

The articulation of the inferior cornua of the thyroid cartilage with the cricoid is enclosed in two *capsular ligaments* lined with synovial membrane. This articulation is a hinge-like joint which allows of a rocking motion of the thyroid cartilage upon the cricoid. The articulation of the arytenoid cartilage with the cricoid is also enclosed by capsular ligaments, lined with synovial membrane, and is of a ball-and-socket-joint character, allowing a rotatory motion of the arytenoid cartilage upon the cricoid, and also a sliding motion in a lateral direction and backward, as well as a rocking forward.

Epiglottic Ligaments.—The epiglottis is connected with the adjacent parts by several ligaments and folds.

1. By the hyo-epiglottic ligament to the hyoid bone. This ligament extends from the anterior surface of the epiglottis near its apex, to the posterior surface of the hyoid bone.

2. By the thyro-epiglottic ligament, a narrow elastic band, to the thyroid cartilage, where it is inserted in the angle of the cartilage just above the middle piece.

3. By the three glosso-epiglottic folds of mucous

membrane by which the epiglottis is attached to the sides and base of the tongue, thus forming two large fossæ between them.

4. By the aryteno-epiglottidean or ary-epiglottic folds, which run from the sides of the epiglottis to the apex of the arytenoid cartilages and contain the cartilages of Wrisberg and of Santorini.

Muscles.—The muscles of the larynx proper are divided into two classes: those which act in moving the vocal cords, and those which are connected in the movements of the epiglottis. The muscles of the first class are again subdivided into muscles which stretch the vocal cords and approach them, and those which relax and separate them.

The *crico-thyroid* (Fig. 28) is the first to attract our attention by its size. It is triangular in shape, overlies the anterior and lateral portion of the cricoid cartilage, and has its origin below in the front and side of the cricoid cartilage. Its fibres pass obliquely upward, and are inserted into the lower and inner borders of the thyroid cartilage. When this muscle contracts it draws the anterior portion of the thyroid cartilage over the cricoid cartilage, thus lengthening and stretching the vocal cords.

The *crico-arytenoideus lateralis*, which arises from the upper border of the side of the cricoid cartilage, and is inserted in the muscular process at the base of the arytenoid cartilage, revolves the arytenoid cartilage upon its base, thus approaching the vocal processes together with the vocal cords.

The *thyro-arytenoid muscle*, a muscle prismatic in its transverse section, which lies along the base of the cords, arises from the base of the middle piece

of the thyroid cartilage, and by a few fibres, which become gradually shorter from the inner side of the

FIG. 28.

View of the internal muscles of the larynx. (ELLIS.)

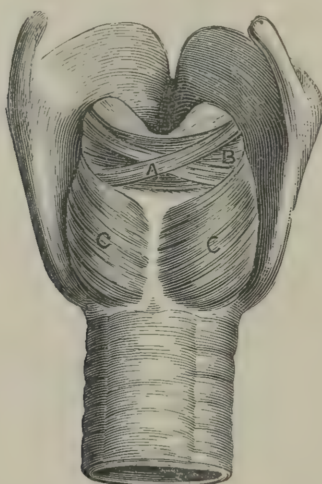
1. Crico-thyroideus detached. 2. Crico-arytenoideus posticus. 3. Crico-arytenoideus lateralis. 4. Thyro arytenoideus, superficial part. 5. Depressor of the epiglottis. 6. Thyro-hyoideus, cut. 8. Deep or transverse part of thyro-arytenoideus.

wings of this cartilage, is inserted into the base and anterior surface of the arytenoid cartilage.

Arytenoid muscle. The arytenoid muscle (Fig. 29), a single muscle, occupies the cavity formed by the

posterior surfaces of the two arytenoid cartilages. It arises from the posterior surface and outer border of one arytenoid cartilage, and is inserted in the corresponding parts of the other cartilage. It consists of three sets of fibres, two oblique and one transverse. The oblique and superficial sets pass from the base of one cartilage to the apex of the other, while the transverse fibres which lie below pass directly across.

Fig. 29.



Posterior view of the larynx. (Ellis)

A. Superficial part of the arytenoideus muscle. B. Deep part of the arytenoideus. C. Crico-arytenoideus posticus.

This muscle, together with the preceding one, is regarded by Luschka as forming a sphincter or constrictor of the glottis. The thyro-arytenoid or vocal muscle, when acting alone, will draw, however, the

vocal cords asunder near their anterior insertion; while the arytenoid, if acting alone, will simply rotate the arytenoid cartilages outwardly, and thus separate the local processes. But both muscles acting together will narrow the glottis by approaching the cords.

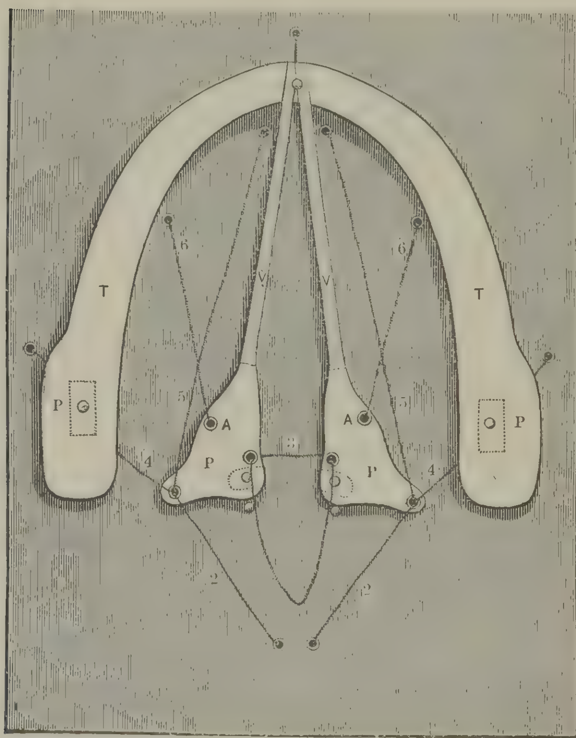
The *crico-arytenoid*, a large fan-chaped muscle which occupies the depressions on either side of the median line of the posterior surface of the cricoid cartilage, arises from this surface. Its fibres, running obliquely upward, are collected into a short tendon, which is inserted into the posterior margin of the vocal process.

This muscle, when contracting, separates the vocal processes of the arytenoid cartilage by rotating them outwardly, and at the same time pulls the arytenoid cartilage downward. The action of these can be better understood by consulting what might be termed a mechanical diagram (Fig. 30).

A diagram of this kind is easily made in the following manner and fully repays for the trouble of making it by greatly facilitating the comprehension of the rather intricate action of these muscles. Let the reader take a piece of cardboard and cut narrow slits into it of the shape, size, and at the position indicated by the dotted line in the diagram. Next cut out of another piece of cardboard an arch, like the one marked T, representing a section of the thyroid cartilage and two smaller pieces like the ones marked A, representing the arytenoid cartilages. Then pass a pin through the points marked on the diagram P, and insert them into the slits cut into the larger piece of cardboard. Let him then paste

two narrow strips of white paper, with their ends close together, on the centre of the arch and each end to the point of the arytenoid cartilages in such

Fig. 30.



Mechanical diagram of the action of the intrinsic muscles of the larynx.

a way that when the arch is drawn away from the lower portion of the diagram as much as the pins in the slit will allow, the strips of paper representing the vocal cords lay flat. A small square piece of

pasteboard should then be passed over the point of each pin projecting on the under side of the large piece of cardboard as a washer, so as to prevent the pieces from dropping off, and the pin points may be bent over so that the model can be laid flat on a table.

The muscles are then represented by strings attached to the movable parts at the points indicated, and are passed through holes in the base cardboard at points also shown in the diagram, so that when pulled upon from behind they will make traction upon the movable parts in the line of force in which the muscles act in the living larynx.

Thus, the string marked 1 represents the crico-thyroid muscle and increases the distance between the vocal processes of the arytenoid cartilages and the anterior angle of the thyroid, thus stretching the vocal cords. The string 2 represents the posterior crico-arytenoids, string 4 the lateral crico-arytenoids, string 3 the arytenoid muscle, strings 5 and 6 the different fibre layers of the thyro-arytenoid, and each one when pulled upon from behind will cause a movement of the vocal cords corresponding with the action of the muscles represented. For class demonstrations such a model is invaluable and should for that purpose be made of wood, but on a much larger scale.

The muscles of the epiglottis are three in number:

1. *Thyro-epiglottideus*, which arises from the inner surface of the thyroid cartilage, passes upward, and is partly lost in the ary-epiglottic fold, and partly

inserted in the margin of the epiglottis. It acts as a depressor of the epiglottis.

2. *Aryteno-epiglottideus superioris*, a small slender muscle consisting of only a few bundles of muscular fibre, arises from the apex of the arytenoid cartilage, and is lost in the ary-epiglottic fold.

3. *Ary-epiglottideus inferioris*, arises from the anterior surface of the arytenoid cartilage. Its fibres pass upward and are inserted into the margin of the epiglottis.

The mucous membrane by which the interior of the larynx is lined is thrown into folds, and, covering the cartilaginous projections and depressions of the skeleton, presents a surface of peculiar shape and form for examination.

We notice, first, the superior aperture of the larynx, a large triangular opening leading to the cavity proper of the larynx. It is bounded in front by the epiglottis, behind by the apices of the arytenoid cartilages, and laterally by the ary-epiglottic folds.

The cavity proper of the larynx (see Fig. 35) extends from this aperture to the lower edge of the cricoid cartilage. It is divided into two parts by the projections formed, inwardly, of the vocal cords, the upper and larger part being elliptical, while the lower and smaller is circular.

The vocal cords are two prismatic bands composed chiefly of the aryteno-thyroid muscle, and a layer of fibres at its free edge, composed of white fibrous tissue with a few fibres of yellow elastic tissue intermingled.

These bands present in cross-section the shape of

a triangle, the upper side of which is concave, while the inner side is convex, with a small notch below the inner angle.[1] This notch is produced by a folding inward of the mucous membrane below the inner edge of the vocal cord, and is seen throughout its entire length. The greater portion of the section is made up of muscular fibres, while only the inner angle is composed of white fibrous tissue containing a few fibres of yellow elastic tissue.

They extend from the vocal process of the arytenoid cartilage to the angle of the thyroid cartilage, where they are attached to the middle piece of the thyroid cartilage. The lower portion of the vocal bands is lost in the crico-thyroid membrane, with which they are continuous. In phonation these bands approach each other with their free edges, and form a narrow chink or slit between them, called the *rima glottidis*. In ordinary breathing this opening becomes large and triangular in shape, the base of the triangle being formed by the upper margin of the posterior plate of the cricoid cartilages, and its sides by the edges of the vocal cords. The mucous membrane covering these cords is of a pearl-white hue, and devoid of ciliated epithelium.

At the base of the vocal cords the mucous membrane is again supplied with the ciliated variety of epithelium, and runs upward and backward for a considerable distance, to be reflected and to come down again to almost the place whence it started, thus forming a deep pouch; it is again reflected and

[1] The designations of the direction are in regard to the larynx, not to the triangle.

runs upward, covering the epiglottis. This duplicature of mucous membrane thus formed, which lies above the vocal cords and runs parallel with them, is called the ventricular band. The pouch spoken of, which is of variable size, and situated between the ventricular bands and the inner side of the thyroid cartilage, is named the sacculus laryngis, while its elongated, elliptical opening is termed the ventricle. In the submucous tissue of this pouch numerous glands are situated, which open into the sacculus, and whose secretion is intended to lubricate the vocal cords. The mucous membrane of the laryngeal surface of the epiglottis is also the seat of numerous glands, whose openings may frequently be seen by the naked eye.

The larynx is supplied with arterial blood by three arteries, viz.: the superior laryngeal, which usually springs from the superior thyroid, but occasionally is derived from the internal carotid, and supplies the muscle and mucous membrane of the upper portion of the larynx; the middle laryngeal or crico-thyroid artery arises from the superior thyroid near the upper margin of the thyroid cartilages, passes downward and divides into two branches, entering the laryngeal cavity at the lower margin of the thyroid cartilage, and supplies the vocal cords and the mucous membrane below them; and, finally, the inferior or posterior laryngeal artery, which is derived from a branch of the inferior thyroid, runs upward and divides into two branches near the lower edge of the thyroid cartilage, one of which joins a branch of the superior laryngeal, while the other supplies the posterior crico-arytenoid muscle.

The veins empty into the superior, inferior, and middle thyroid veins.

The nervous force is supplied by the superior laryngeal and the inferior recurrent laryngeal branch of the pneumogastric, and also by a few fibres of the sympathetic and spinal accessory.

The superior laryngeal nerve is in the main a sensory nerve and gives sensation to the laryngeal mucous membrane, but it also contains a motor branch which supplies the crico-thyroid muscles, while the inferior laryngeal is exclusively a motor nerve and innervates the other laryngeal muscles. The arytenoid receives filaments from both the superior and inferior nerves. The recurrent branches of the pneumogastric are united by a *chiasm*, which fact, before surmised, was established by experiments madè on the body of a criminal by Dr. W. W. Keen and myself.

Besides the muscles described as belonging to the larynx proper, there are other muscles which by their action determine the position of the larynx in the throat. These are the so-called extrinsic muscles of the larynx, and comprise the sterno-thyroid, the thyro-hyoid, the omo-hyoid, and the sterno-cleido-mastoid.

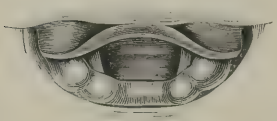
Thyroid Gland.—The thyroid gland, a large ductless gland, divided into two lobes by the isthmus, is situated in the anterior part of the neck, overlying the trachea below the cricoid cartilage. Occasionally a third lobe of this gland is met with, which, when it is present, overlies the trachea extending for some distance above and below the isthmus. This

anomaly of the thyroid gland should not be lost sight of in the operation for tracheotomy.

The Laryngeal Image.

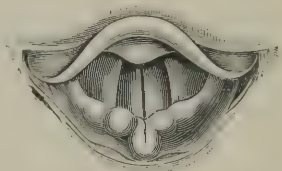
Supposing that the mirror, after having been introduced, displays a complete image of the laryngeal opening, such as is seen in Figs. 31 and 32, we

Fig. 31.



Laryngeal image during respiration.

Fig. 32.



Laryngeal image during phonation.

observe a reddish-yellow arch, sometimes notched in the centre, with a roundish protuberance in front of it, of the same color, but not so well illuminated.

This arch is the upper margin of the *epiglottis*, and the backward bend of the organ near its insertion into the angle of the thyroid cartilage. In front of this protuberance, extending across the surface of the mirror, are seen two pairs of bands, the outer reddish, and the inner pearl-white when normal. These are the ventricular bands and vocal cords. In quiet breathing a triangular space is noticed between the inner bands, with its apex posterior, and usually hidden by the arch of the epiglottis. In phonation this space is narrowed down to a slit, and is designated by the name *glottis*.[1]

[1] The name *glottis* is frequently applied to the whole opening of the larynx, and in many books a very vague idea is given of its extent. By common consent, the term is applied to the space between the edges of the cords only.

In front, at the termination of the vocal cords, we notice two roundish prominences, with a depression between them when the patient is breathing, but closely applied to each other in vocalization. These are the arytenoid cartilages as seen from above. On either side a curved band, with its concavity inward, extends backward to join the arch of the epiglottis. Along the course of these bands, which are the *ary-epiglottic folds*, we see two small nodules, the cartilages of Wrisberg and of Santorini.

In the female larynx we see, along the inner edges of the vocal cords, two yellowish stripes, very narrow and tapering toward their ends. These are the cartilages of Seiler, which are only rudimentary in the male larynx.

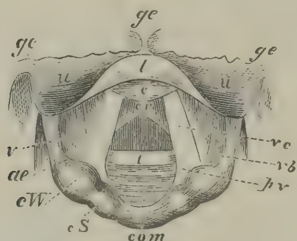
Behind and above the arch of the epiglottis, two dark oval spaces, separated by a light band running backward, are observed. These are the depressions on either side of the glosso-epiglottic fold, while the light band separating them is the fold itself (Figs. 33 and 34).

By directing the reflected light a little forward, we see back of these depressions a surface studded with round eminences—the back of the tongue, with its papillæ.

Through the glottis when fully opened we can see into the inferior cavity of the larynx below the vocal cords, where a broad yellow band, the *cricoid* cartilage, appears, and below it the rings of the trachea elevating the mucous membrane. Not infrequently, two dark circles separated by a bright line may be seen in the depths of the trachea, indicating the openings of the bronchi, and the bifurcation of the trachea. In very rare instances a beam

of light can be thrown into the right bronchus, but very little can be seen under such circumstances, as

FIG. 33.



Laryngoscopic diagram showing the vocal cords widely drawn apart, and the position of the various parts above and below the glottis during quiet breathing. (From MACKENZIE.)

g. e. Glosso-epiglottic fold *s*. *u.* Upper surface of epiglottis. *l.* Lip or arch of epiglottis. *c.* Protuberance of epiglottis. *v.* Ventricle of the larynx. *a. e.* Ary-epiglottic fold. *c. W.* Cartilage of Wrisberg. *c. S.* Cartilage of Santorini. *com.* Arytenoid commissure. *v. c.* Vocal cord. *v. b.* Ventricular band. *p. v.* Processus vocalis. *c. r.* Cricoid cartilage. *t.* Rings of trachea.

FIG. 34.

Laryngoscopic diagram showing the approximation of the vocal cords and arytenoid cartilages, and the position of the various parts during vocalization. (From MACKENZIE.)

f. i. Fossa innominata. *h. f.* Hyoid fossa. *c. h.* Cornu of hyoid bone. *c. W.* Cartilage of Wrisberg. *c. S.* Cartilage of Santorini. *a.* Arytenoid cartilages. *com.* Arytenoid commissure. *p. v.* Processus vocalis and cartilages of Seiler.

everything is very indistinct and differences of color cannot be determined.

The normal color of the mucous membrane is a pinkish-red, varying in shade in different localities. Thus, the epiglottis is usually of a yellowish tint, caused by the shining, through the thin layer of mucous membrane, of the cartilage. The pearly white of the vocal cords, which has already been mentioned, serves as a landmark to the beginner in laryngoscopy. There may be, however, considerable variation of color in the mucous membrane within the limits of health, in different individuals, and even in the same individual under different circumstances, as, for instance, after a meal the mucous membrane is darker than before meals, and when viewed by a white light, as already mentioned, it appears lighter than when a yellow light is used for illumination.

The shape of the different parts also may vary considerably without being abnormal, and this is especially the case in the shape of the epiglottis, which may be curled upon itself or be flat, may have a notch in the middle of the upper margin, or may, instead of it, be pointed, etc.

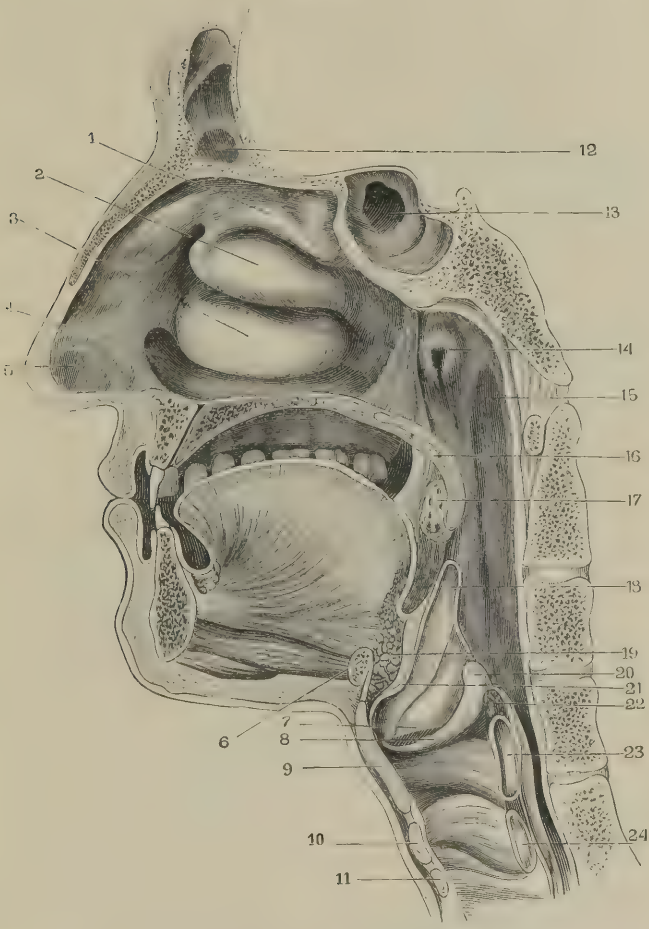
The arytenoid cartilages also vary considerably in size and shape, and even in their movements during phonation, for I have frequently seen cases in which the arytenoid cartilages, instead of simply being pressed against each other in phonation, partially passed each other, so that the vocal processes seemed to lap without in the least interfering with the function of the vocal cords.

Anatomy of the Nasal Cavities.

The nasal cavities, which are wedged-shaped, with a narrow arched roof, extend from the nostrils to the upper portion of the vault of the pharynx (Fig. 35). Their outer walls are formed in front by the nasal process of the superior maxillary and lachrymal bones, in the middle by the ethmoid and inner surface of the superior maxillary bones, behind by the vertical plate of the palate bone, and the internal pterygoid process of the sphenoid and turbinated bones. These latter run from before backward, three on each side, and are designated as the inferior, middle, and superior, the latter being the smallest of the three. The superior turbinated bone is, however, usually only rudimentary in the adult nose, and is even not infrequently altogether absent. In the fœtus and in early childhood it is generally large and often divided into two unequal portions by a cleft running parallel with its longitudinal diameter. The spaces or sinuses between these turbinated bones are called meatuses, so that the space between the floor of the nose and the lower turbinated bone is called the inferior meatus, the one between the lower and the middle turbinated bone is the middle meatus, and the one between the middle and superior turbinated bones is the superior meatus.

The nasal cavities are separated from each other by a septum or division-wall, composed of the perpendicular plate of the ethmoid bone and the vomer posteriorly and the cartilaginous septum anteriorly,

Fig 35.



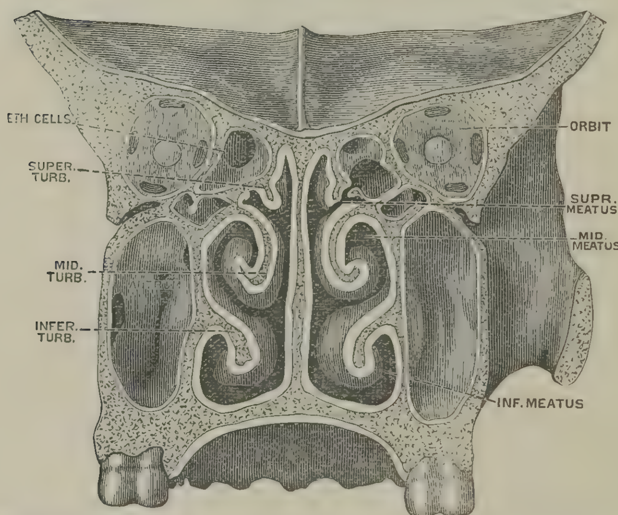
Vertical section of head; slightly diagrammatic.

1. Superior turbinated bone. 2. Middle turbinated bone. 3. Lower turbinated bone. 4. Floor of nasal cavity. 5. Vestibule. 6. Section of hyoid bone. 7. Ventricular band. 8. Vocal cord. 9 and 23. Section of thyroid cartilage. 10 and 24. Section of cricoid cartilage. 11. Section of first tracheal ring. 12. Frontal sinus. 13 Sphenoidal cells. 14. Pharyngeal opening of Eustachian tube. 15. Rosenmüller's groove. 16. Velum palati. 77. Tonsil. 18. Epiglottis. 19. Adipose tissue behind tongue. 20. Arytenoid cartilage. 21. Tubercle of epiglottis. 22. Section of arytenoid muscle.

thus presenting a smooth surface as the inner wall of each cavity.

The floor is formed by the palatine process of the superior maxillary bone and by the palate bone, and runs in a slanting, downward direction from before backward. The roof is formed by the nasal bones and nasal spine of the frontal in front, in the middle by the cribriform plate of the ethmoid, and posteriorly

Fig. 36.



Transverse vertical (*i. c.* coronal) section of the nasal fossæ at the plane of the second molar teeth, seen from behind. (Hirschfeld.)

by the under surface of the body of the sphenoid bone. Directly communicating with the nasal cavities by narrow channels are other cavities, situated in the bones of the skull, the lining mucous membrane of which, no doubt, is sometimes affected by the patho-

logical processes in nasal diseases. These are the antra of Highmore—large triangular cavities situated in the body of the superior maxillary bone, and communicating with the nasal cavities by an irregularly shaped opening in the middle meatus; which, according to John N. Mackenzie, is partly covered with a fold or projection of the nasal erectile tissue; then the frontal sinuses—two irregular cavities situated between the two tables of the frontal bone. The communication between them and the nasal cavities is established by the infundibulum—a round opening in the middle meatus—and finally the spheniod cells or sinuses found in the body of the sphenoid bone, communicating with the nasal cavities by small openings in the superior meatus.

That portion of the nasal cavities which projects beyond the end of the nasal bone is surrounded by cartilages, forming the alæ of the nose.

In the cartilaginous septum of the lower animals we find a small cavity lined with mucous membrane, called, after its discoverer, Jacobson's organ, the minute anatomy of which has lately been described by Kline. This organ in man is, however, only rudimentary.

The nasal cavities are lined with mucous membrane, which varies greatly in thickness in different localities, and which materially decreases the size of the cavities in the living subject from that seen in the denuded skull. This mucous membrane is covered by ciliated epithelium in man, with the exception of that portion which lines the vestibule, *i. e.*, that portion of the cavities of the nose surrounded by cartilage only, which is covered by pavement

epithelium. In the lower animals we find that in the olfactory region the ciliated epithelium is either absent, or that ciliated and non-ciliated epithelium alternate in patches. (Henle.) I have not been able to find a statement in the literature on the subject as to the kind of epithelium found in the accessory cavities in man, but it is very probable that the mucous membrane of the frontal sinuses and the antra of Highmore is covered with ciliated epithelium, otherwise it would be difficult, if not impossible, for the secretions of that mucous membrane to pass through the narrow channels into the nasal cavities. To the naked eye, however, the membrane lining the antra appears, according to John N. Mackenzie, thin, loose, and serous-looking, and seems to have a great power of absorbing liquids.

The color of the normal nasal mucous membrane is of a light-pink shade in what is termed the respiratory portion, while it is of a yellowish hue in the olfactory region, that portion of the mucous membrane which covers the roof and outer wall of the nasal cavities down to the upper margin of the middle turbinated bone, and the septum down to about the same level. It is in this region that the nerve-ends of the olfactory nerve are distributed. Immediately beneath the mucous membrane, and between it and the periosteum of the bony walls and the perichondrium of the cartilaginous portion of the septum, we find a tissue which bears a striking resemblance to the erectile tissue of the genital organs. It is a network of fibrous tissue, the trabeculæ of which contain a few organic muscular fibres. Its meshes, of various sizes and shapes, are

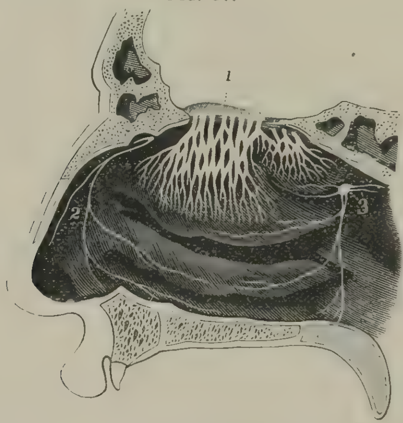
occupied by venous sinuses lined with endothelium. These are supplied with blood by small arterioles and capillaries, which are quite numerous in the fibrous tissue and can readily be demonstrated under the microscope. In this arrangement of elements of the nasal mucous membrane we find a ready explanation of the fact that liquids of greater or less density than the serum of the blood, when introduced into the nasal cavities, produce pain, for we have here the most favorable conditions for osmosis, which will cause either a contraction or a distention of the sinuses. In the larger masses of fibrous tissue between the sinuses or caverns we find embedded the glands, with their ducts opening out between the epithelial cells of the mucous membrane. There are two kinds of glands in this region, which have been described by Kline, viz., serous and mucous glands.

This cavernous erectile tissue is most abundant at the lower portion of the septum and the lower turbinated bone, and although it has been recognized and described as true erectile tissue by Henle, Virchow, and others, yet to Prof. Bigelow, of Boston, belongs the honor of having first called attention to the part which this tissue plays in nasal disease. He gave to it the name "turbinated corpora cavernosa."

The naso-pharynx, into which the nasal cavities open by the posterior nares, contains the openings to the Eustachian tubes on either side, and the pharyngeal tonsil, a mass of glands situated below the mucous membrane and opening into a number of follicles, some of which are quite large and readily seen in the rhinoscopic mirror.

Nerves.—The nerves of the nose are of two kinds, viz.: those of special and those of general sensation. The former consists of filaments from the olfactory bulb, which are distributed upon the superior turbinated bone, the anterior upper third of the middle turbinated bone, and upon the adjacent portion of the septum, and are only concerned with the special sense of smell.

Fig. 37.

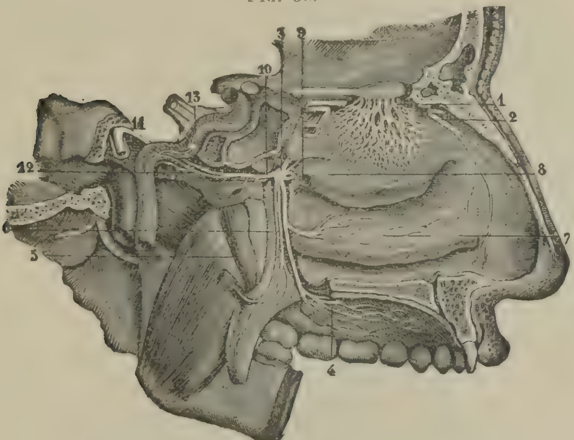


Distribution of nerves in the nasal passages. (Dalton.)
1. Olfactory bulb, with its nerves. 2. Nasal branch of the fifth pair.
3. Spheno-palatine ganglion.

The nerves of general sense are the nasal nerve, a branch of the ophthalmic division of the trifacial nerve, which ramifies upon the upper and anterior portion of the septum, and upper portion of the external nasal wall. The spheno-palatine branch of the second division of the fifth, which is distributed over the upper posterior portion of the septum and the superior turbinated bones.

The Vidian, which has a similar distribution to the spheno-palatine branches.

FIG. 38.



Olfactory ganglion and nerves. (HIRSCHFELD.)

1. Olfactory ganglion and nerves. 2. Branch of the nasal nerve. 3. Spheno-palatine ganglion. 4, 7. Branches of the great palatine nerve. 5. Posterior palatine nerve. 6. Middle palatine nerve. 8, 9. Branches from the spheno-palatine ganglion. 10, 11, 12. Vidian nerve and its branches. 13. External carotid branch, from the superior cervical ganglion.

The naso-palatine, which supplies the middle part of the septum, and the anterior palatine nerve, which supplies the middle and inferior turbinated bones. Some filaments of the sympathetic can also be traced in the nasal mucous membrane. (Figs. 37 and 38.)

THE RHINOSCOPIC IMAGE.

On account of the velum palati and the uvula covering the greater part of the reflecting surface of the mirror in rhinoscopy, a complete image can only

be obtained in cases of cleft palate; but, by observing the different parts of the posterior nares in turn, a diagrammatic image can be constructed, which is, perhaps, for study, even better than one drawn from nature. Such a drawing is seen in Fig. 39.

We see in the middle of the drawing a triangular plate with its apex downward; this is the posterior margin of the vomer or nasal septum. On either side we notice curtain-like folds projecting toward the septum; these are the posterior aspects of the

Fig. 39.

Rhinoscopic image.

1. Vomer or nasal septum. 2. Floor of nose. 3. Superior meatus. 4. Middle meatus. 5. Superior turbinated bone. 6. Middle turbinated bone. 7. Inferior turbinated bone. 8. Pharyngeal orifice of Eustachian tube. 9. Upper portion of Rosenmüller's groove. 11. Glandular tissue at the anterior portion of vault of pharynx. 12. Posterior surface of velum.

turbinated bones. On either side of these and on the margin of the drawing we notice pointed elevations projecting toward the interior of the cavity, with a crater-like depression on their apices; these are the lateral pharyngeal walls, with the orifices of

the Eustachian tubes. Above we see the vault of the pharynx, and below the posterior surface of the velum palati with the uvula.

The obstacles which have to be overcome in obtaining a view of the posterior nares are, first, the elevation of the back of the tongue, which, as we have seen, can be surmounted by gentle pressure with the tongue-depressor; and, second, the elevation of the soft palate. This latter, however, does not, as a general rule, prevent an inspection of the nasal cavity; for the velum drops in the act of inspiration through the nose, even if only for a short time.

If the uvula is elongated or very large, it is difficult to obtain a satisfactory view of the posterior nares, and it becomes necessary to move it out of the way. This may be done in many cases by passing another small rhinoscopic mirror behind the uvula and velum, with the glass side toward the posterior upper surface of the palate. In this way the swollen uvula may be lifted up, and by gentle pressure the velum drawn forward, thus increasing the space in the pharynx, and removing the obstacles to rhinoscopy. If, however, the patient, as is often the case, cannot bear this, a silk suture may be looped around the base of the uvula, and gentle traction having been made, the ends of the thread are secured between the teeth of the patient, thus drawing the uvula forward and out of the way. This, however, is but rarely necessary, except in cases of operation in the naso-pharynx, and then Jarvis's method of securing the soft palate, already described, is preferable.

Although apparently simple and easy, the art of

laryngoscopy and rhinoscopy is a difficult one, and requires careful training of the hand and eye to become proficient in it. For this reason the student should not become discouraged if, after a few trials, he is not able to see the vocal cords or the posterior nares in the mirror, but should keep on undaunted until he has attained the necessary skill in placing the mirror in the right position, and throwing the light from the head-reflector in the right direction, when without difficulty he will be able to obtain the laryngeal or rhinoscopic image. But in a large number of cases, unaccustomed to the presence of the mirror in the fauces, he will be able to see this image for a moment only before gagging sets in, and the mirror has to be removed. The mirror may be introduced again and again, and thus a series of momentary pictures may be obtained, which must be combined in the mind of the observer to form the permanent mental impression of the pathological changes which may exist in a given case. In order to facilitate this mental process, and to educate the eye so that many, if not all, the details forming the image may be taken in and recognized at a momentary glance, it is best that the student should adopt a system of examination, to be followed in every instance, by which one detail after another forms the centre of observation. The following outline of a system will make my meaning clear.

First examine the tongue: whether there are any ulcerations or mucous patches, whether coated or clean, pale and flabby, or of a natural color and resistance. Then, after having depressed the tongue, observe the palate and uvula, the anterior pillars,

the tonsils, and posterior pillars, and the posterior wall of the pharynx, and note any changes in color of the mucous membrane and condition of its surface, enlargement of the parts, as, for instance, hypertrophy of tonsils, elongation of uvula, enlargement of follicles in pharynx, etc.; the presence or absence of foreign bodies, hardened secretion, abrasions or ulcerations of the mucous membrane; and finally, mobility and functional disturbances of the parts. The laryngeal mirror may then be introduced and the details of the image examined, always retaining the order in which the physical and functional conditions of the parts are to be observed, viz., 1. Color and condition of surface of the mucous membrane. 2. Size and shape. 3. Loss of substance (ulcers, abrasions, etc.). 4. Presence of foreign bodies or accumulation of secretion; and 5. Mobility of parts and functional disturbances. Thus it will be found convenient first to examine the epiglottis and its appendages, the glosso-epiglottic and the ary-epiglottic folds, then the arytenoid cartilages, next the ventricular bands, and finally the vocal cords. If possible, also the trachea as far as it can be seen. In the same manner should the rhinoscopic image be viewed, taking note first of the condition of the pharyngeal tonsil and the roof of the naso-pharyngeal cavity, next of the openings of the Eustachian tube and the lateral walls of the cavity, and finally of the posterior aspects of the turbinated bones and of the vomer.

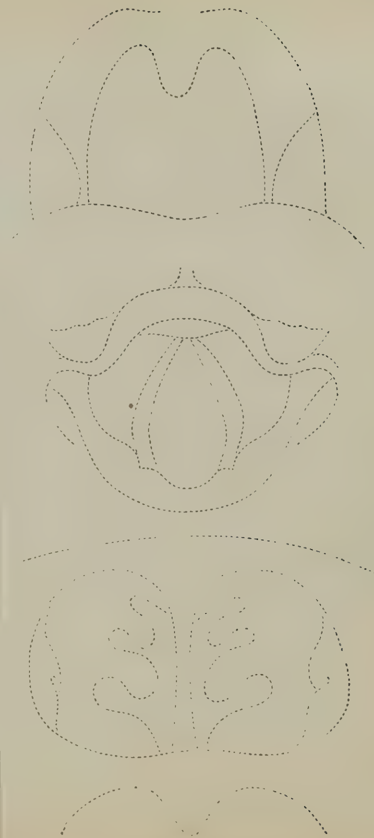
The inspection of the anterior nares should be conducted in the same systematic manner, using the probe to test the consistency of the parts by the sense of touch.

Name, etc., of patient ....

Previous and family history ....

Subjective symptoms ....

		Color and Surface	Secretion.	Position and Shape.	Mobility.	Foreign Bodies and Neoplasms.
Fauces.	Tongue,					
	Velum,					
	Uvula,					
	Pillars,					
	Tonsils,					
	Wall of Pharynx,					
Larynx.	Epiglottis,					
	Ary-epiglottic Folds,					
	ArytenoidCartilages,					
	Ventricular Bands,					
	Vocal Cords,					
	Trachea,					

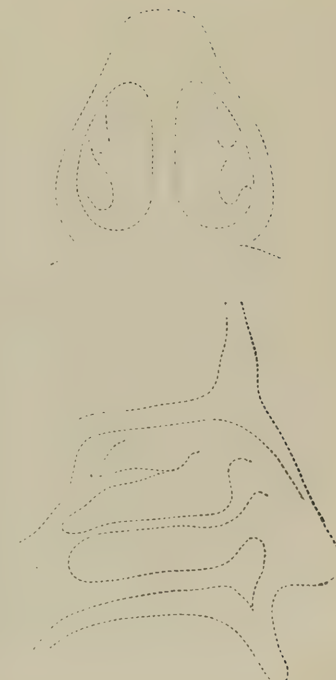


Naso-pharynx.

- Vomer,
- Turbinated Bones,
- Eustachian Tubes,
- Pharyngeal Tonsils,

Nasal Cavities.

- Turbinated Bones,
- Septum,
- Floor of Nose,
- Meatuses.



An examination of the upper air-passages conducted on this plan will enable the observer to arrive at a definite conclusion in regard to diagnosis more quickly and with less annoyance to the patient, than if he should attempt to take in all the details at a glance. As the examination progresses, the result of the observations can be jotted down on paper, and thus a very complete record of the case will be obtained, especially if any deviations in shape or size of the parts, or the presence of foreign bodies or neoplasms, be sketched on the margin of the sheet, which will be valuable not only for future reference, but also in watching the progress of the case. The subjective symptoms, such as cough, pain, etc., should of course be added, as well as the salient points of the previous and family history of the patient.

A record sheet of this kind on which the headings are printed and the outlines of the parts added, will serve as an illustration, and it will be seen that a very full history, with a minimum of trouble and expenditure of time, can be obtained by filling in the blanks.

CHAPTER IV.

PHYSIOLOGY OF THE LARYNX AND NOSE.

A THOROUGH knowledge of the physiological functions of the upper air-passages is as necessary for the student of laryngology and rhinology, as is the knowledge of the anatomy, and for this reason a chapter on the functions of the larynx, pharynx, and nose, will not be out of place in this volume. There are many cases in which functional disturbances of these organs are present, the recognition of which materially aids in the diagnosis of the case, and frequently the seat of the disease can be located, even without examination, by studying the changes in the voice and in articulation. At the same time many of the remote symptoms so frequently seen in nasal diseases, and generally ascribed to reflex nervous influences, will be found to be due directly to disturbances of the function of the nose.

PHYSIOLOGY OF THE LARYNX.

The function of the larynx is a three-fold one, namely:

First. The regulation of respiration, which is effected by the vocal cords opening and closing so as to let more or less air pass through the glottis to and from the lungs. This motion of the cords can be readily studied in the laryngeal mirror during quiet respiration, and it enables us to prevent a too

rapid outflow of the breath in singing or speaking. If no such regulation existed, it would be impossible for us to sing a phrase or speak a sentence without interrupting the flow of sound by frequent respiratory movements, or as is the case in the so-called laryngeal stammering, in which affection the first word of the sentence after inspiration is spoken with all the usual expiratory air, while the other words must be pressed out with the residual air in the lungs, giving a peculiar character to the voice of the speaker.

Second. The protection of the laryngeal cavity and trachea from the introduction of foreign bodies during the act of deglutition. This is effected partly by the epiglottis bending backward and covering the laryngeal opening, and partly by the ventricular bands being tightly pressed together during the passage of food from the pharynx into the œsophagus. The ventricular bands alone are sufficient thus to exclude foreign bodies from the larynx, as is easily seen in cases of partial or complete destruction of the epiglottis by ulceration.

Third. Voice-production on vocalization. This important function, the study of which gave rise to the invention of the laryngoscope, is even at the present day but little understood by most of those who, by their calling, should be better informed, and it will perhaps be well to consider it more in detail than seems necessary for the scope of this volume. But before entering upon voice-production as we find it in man, as vocalization or singing without words, and articulation or speech, we must consider a few of the acoustic laws which underlie this function of the larynx.

Acoustics.—Sound is a vibratory motion of the air producing waves, or a sequence of condensation and rarefaction of the air, which on striking upon the tympanic membrane of the ear gives rise to the sensation called sound. This vibration is produced in turn by any body which executes a rapid to-and-fro motion; in other words, which vibrates. Sounds differ from each other—1st, in pitch, or the position of the tone in the musical scale, which depends upon the rapidity of the vibration and is determined by the length of the wave; 2d, in loudness, which depends upon the largeness or amplitude of the vibration and air-wave; and 3d, in quality or character, which depends upon the form of the vibration or wave.

No sound which we hear, except the sound of a tuning-fork, is simple, but all single sounds are composed of a fundamental tone which determines the pitch, and of a greater or less number of overtones, which by the unaided ear are not audible as such, but which in mingling with the fundamental tone change the form of the wave and thus influence the character of the sound.

The original vibrations producing the sound-waves may be produced by any body which possesses elasticity, such as a steel rod, or to which elasticity has been imparted by stretching, as is the case with strings. Even a column of air confined by resisting walls, but communicating with the outer air, may under certain circumstances become a vibrating body. Since strings or string-like bodies and a column of air are the vibrating bodies in

voice-production, we will inquire a little more closely into the acoustic laws governing them.

A string in order to be able to vibrate and to give forth sound must be stretched between two resting points, and must be set in vibration by some force external to it. The longer the string is, the lower will be the pitch of the tone, and this pitch can be raised by shortening the string. The greater the power by which the string is stretched, the higher will be the pitch; and, finally, the thicker and heavier the string, all other conditions being the same, the lower will be the pitch.

A column of air or gas being, to all intents and purposes, a string of a lighter material, obeys the same laws, with the exception that, being elastic, it need not be stretched nor can the pitch be changed by stretching. This is compensated for, however, by the fact that the pitch of a column of air may be changed by altering the size of the opening by which it communicates with the outer air; and it is a law that the larger the opening the higher the pitch, and the smaller the outlet the lower will be the pitch.

The sound of an elastic body, such as a string or membrane, when vibrated in close proximity to a cavity filled with air, causes the air to vibrate, and the amplitude of the wave being thus increased the sound is made louder. This is called "resonance," and its best effect—viz., the greatest volume of sound—is obtained when the column of air is made to vibrate with the same velocity as the string; in other words, when the string and air-column are tuned alike. The effect of resonance upon the character or quality of the sound is very noticeable, and

depends upon the fact that through changes in the form and shape of the air-column some of the overtones can be strengthened or favored, while others are weakened or extinguished altogether, thus changing the shape or form of the wave.

Voice-production.—Having thus briefly reviewed the acoustic laws involved, we are now prepared to enter into a consideration of voice-production as it goes on in man.

The first step is the inhalation of air into the lungs, or inspiration. This air is then allowed to flow gently through the bronchial tubes into the trachea by a mild expiratory effort until it reaches the vocal cords. These during respiration are held asunder, so that they allow the air to flow freely through the large triangular space between their free edges, which is called the glottis; but as soon as vocalization is attempted they are approximated until the glottis is reduced to a narrow chink; and this is effected by the approximation and inward rotation of the arytenoid cartilages, to which the vocal cords are attached. The narrowing of the glottis presents an obstacle to the outflowing air-current, and since the vocal cords are also slightly stretched and thus made elastic, they are bulged upward by the pressure from below until their elasticity overcomes the pressure, when they fly back to their normal position. This motion is repeated in rapid succession, and thus the vocal cords are set in vibration; which can readily be seen in the laryngoscopic mirror, by means of which all the changes that take place in the vocal cords during vocalization have been observed. Drs. T. R. French, of

Brooklyn, and Lenox Browne, of London, by means of their ingenious apparatus for photographing the interior of the larynx, have produced some excellent pictures of the vocal cords during vocalization, which verify the observations made by the laryngoscope, and which show the different positions taken by the cords in the different registers of the voice, as described farther on.

The vibration of the vocal cords alone gives but a very feeble and disagreeable sound, as has been clearly demonstrated by experiments on the larynx removed from the body and in cases of wounds of the neck exposing the vocal cords and separating them from the resonant cavities above. What is more, the compass of the voice—*i. e.*, the number of tones of different pitch—is very limited, comprising but a few tones of the musical scale. The sounds produced by the vocal cords alone are very similar in character and variety, as well as in number, to those produced by the double reed of a bassoon or hautboy when it is vibrated alone and detached from the instrument. As soon, however, as a column of air is brought in contact with it, this latter becomes a self-sounding body, and not only increases the volume and number of the tones, but also changes their character or quality. The same is the case with the vocal cords, which, in causing the column of air contained in the pharyngeal and oral cavities to vibrate, make it a self-sounding body, and thus volume and character are added to the sound. This is still more increased by the vibration of the air contained in the cavities of the naso-pharynx and nose, which, although separated from the direct in-

fluence of the vibrations of the vocal cords by the adaptation of the soft palate to the pharyngeal wall, or rather to the ridge produced by the lower constrictor muscle of the pharynx, still partakes of the vibratory motion, and adds volume and quality to the sound, just as the air contained in the body of a violin adds greatly to the tone of the instrument.

The pharyngeal cavity can be changed in size by the rising and falling of the larynx in the throat, and the oral cavity can also be changed in its dimensions by the action of the tongue, the cheeks, and the lower jaw; and these cavities can thus be attuned to the pitch of the sound produced by the vibration of the vocal cords, whereby, as was shown above, the best effect of tone is obtained.

But the oral cavity can also be tuned to a definite pitch by the changeable opening of the lips, as well as by the motion of the tongue and cheeks, and thus still another means is provided for this purpose. This adjunct is of great importance, not only in articulation, as will be seen later on, but also in vocalization; for in order to produce a low pitch the cavity of the mouth would have to be made as large as possible, which can be done only by depressing the tongue to its utmost, thus pushing the root down upon the larynx and encroaching upon the pharyngeal cavity, which would not only materially interfere with the activity of the laryngeal muscles, but would also hinder the free vibration of the column of air. But since a cavity of air can be tuned lower by making the opening by which it communicates with the outer air smaller, and *vice versâ*, the cavities can be tuned to even the lowest tone of the voice by

slightly closing the lips and making the cavities as voluminous as possible without interfering with the free motion of the air contained in them.

This attuning of the resonant cavities above the vocal cords, although natural to man, requires considerable practice for its full development, and it is the quickness and precision with which the different movements are executed in these cavities which make what is called a "trained voice." It naturally follows that a voice weak in volume and deficient in quality can be made to sound stronger and more agreeable by such training. On the other hand, a naturally good and strong voice may materially be altered for the worse by interfering with the oral resonance, be it by the use of too much breath, or by a faulty attuning of the resonant cavity, or, finally, by permanent alteration of this cavity by growths, paralysis of the soft palate, or a faulty artificial denture.

There are in every voice, both male and female, certain divisions which can be differentiated from each other both by the volume and quality of the individual tones within the limit of the division, and these have been termed "registers" of the voice. They are variously designated by singers and teachers of vocal music according to their fancy; but we will, for the sake of simplicity, accept those terms which are most generally used. Thus, the voice is divided into—1, the lower chest register; 2, the upper chest; 3, the falsetto; and in the female voice we find also a second falsetto, and finally a head register. These names are derived from the feelings which a singer experiences during the act of vocalization in

the different registers. Thus he feels as though the voice came from the lower part of the chest in the lower division; a little higher up, in the second; from the throat in the falsetto, which is therefore also frequently called the throat register; or from the top of the head in the head register.

Let us now examine the movements of the vocal cords more closely during the act of vocalization, particularly when the subject of our examination sings up the scale, commencing with the lowest note of his voice, and we will see that these divisions of the voice are not merely based upon the subjective impressions received by the ear of the listener, but are dependent upon important changes which take place in the position and movements of the vocal cords themselves.

As we have already seen, the vocal cords are stretched between their attachments, and are brought together by the approximation and inward rotation of the arytenoid cartilages as soon as an attempt at vocalization is made. If now the singer, whose larynx we observe with the laryngeal mirror, sings the lowest tone of his voice, the first tone of the chest register, we see that the glottis, or chink between the free edges of the vocal cords, has the shape of an ellipse, and that the cords vibrate slowly in their entire length and width; in fact, the walls of the larynx itself participate in the vibratory motion. As soon as the next tone in the scale is attempted, the arytenoid cartilages, with a quick motion, fly asunder and come together again, but a little closer than before, making the glottis slightly narrower, and the cords are at the same time stretched a little more.

This is repeated with every successive tone in the scale until the limit of the register is reached, when at the next tone, the first in the higher division, the arytenoid cartilages remain closed, and the participation of the laryngeal walls in the vibratory movement ceases. The vibration of the cords is also less apparent, because quicker and less violent, but still they vibrate in their whole length and width.

At the end of this register a very noticeable change takes place, for with the first tone of the falsetto or throat register, the glottis, which hitherto was comparatively wide, is reduced to a mere slit, and only the narrow edges of the cords vibrate, which seem quite thin and sharp. This is produced by the unfolding of the fold below the edge of the cord which was described above, and by the contraction of the muscular fibres forming its body. As in the lower chest register, the arytenoid cartilages again fly asunder, but the motion is performed so quickly as to escape notice in many cases. In the female voice—and but rarely in the male—a second falsetto is noticed, which, like the second chest register, differs from the first falsetto merely in the fact that the arytenoids remain in close juxtaposition, while the cords are stretched tighter with every successive tone.

Finally, the head register is reached, which is peculiar to the female voice, and, with its flute-like tones, is due to the posterior portion of the glottis being completely closed by the apposition of the cartilages of Seiler, while only the anterior portion of the cords vibrates, thus making the vibrating cords shorter and increasing the pitch of the tone.

With every successive tone this shortening process progresses, until at the highest tone of the female voice only a small elliptical opening at the anterior portion of the glottis, the edges of which vibrate, allows the air to pass through.

In the so-called whispering voice, the action of the vocal cords, according to Rossbach and other investigators, is different from loud vocalization, and by the laryngoscope it is observed that the anterior portion of the vocal cords is approximated until they overlap, while the posterior portion of the glottis, which is bounded by the vocal processes of the arytenoid cartilage, is open, and allows the air to pass, setting its rigid edges into irregular vibrations, much in the same manner as the lips are vibrated in soundless whistling. As a matter of course, no sound, as such, is produced by the vocal cords, and any changes in the pitch and quality of the whispering noise which can be observed, are imparted to it by changes in the resonant cavities above the vocal cords. Thus the whispering voice, or the noise produced by the rush of air through the triangular opening of the glottis, may be utilized with advantage in studying the changes in the resonant cavities, and in determining the pitch to which they are tuned in some of the sounds of articulate speech.

Articulation.—In the preceding pages we have considered vocalization, or voice-production, without words, and it now remains to describe the method by which the various sounds are produced which, when uttered, consecutively, in a certain order, produce what is termed "articulate speech." Since

this volume is written in the English language, and will be read mostly by English-speaking readers, all those sounds which enter into the composition of other languages and are foreign to English, will be omitted.

But in order properly to understand a subject, and particularly one which, like articulate speech, is so well known to every one, and at the same time thoroughly understood by so few, it seems to us proper to give a definition of our subject before we enter upon a detailed description of it, and we, therefore, will endeavor to define Language, Dialect, and Accent.

Language, as used by man, is the arbitrary but constant sequence of articulate sounds, forming what are termed words, and expressing, as such, simple ideas, and the arbitrary but constant sequence of words termed sentences, expressing compound ideas. The difference between different languages consists in the fact that the same simple idea is expressed by different but constant combinations of articulate sounds, and that the compound ideas are expressed by different but constant sequences of words. In languages which are related to each other a similarity both in the words and sentences can be observed, but in those not so related a great dissimilarity in words and sentences exists.

Dialect is the substitution of other articulate sounds for those which are correct in the language, without, however, entirely destroying the characteristic sound of the word expressing the simple idea, and the introduction into the sentences of words foreign to it,

or of a change in the sequence of the words of the sentence without destroying its characteristics. Thus a dialect is only a variety of the language, and is limited to people living in a particular locality, or who belong to different nationalities or races, all, however, speaking the same language.

Accent, by which is understood the peculiarity of speech characterizing foreigners speaking a language different from their-mother tongue, and which is perceptible, even if the language is spoken correctly, in regard to pronunciation, grammar, syntax, and even colloquialisms, consists in the peculiar inflection of the voice in speaking, or, as it may be expressed, in the peculiar melody of speech. Every language possesses this characteristic melody, which is independent of the accentuation of the individual words and of the inflection of the voice demanded by the sense of the sentence; and so definite is this, that a language can be recognized even if the speakers are too far removed from the listener for the latter to hear and recognize the individual words and sentences. And, further, we find a great similarity in the melody of the languages which are related to each other, so that it is difficult to distinguish German from Swedish and Italian from Spanish without hearing and understanding the individual words, while there is no difficulty in appreciating the difference between English and French, even if the listener should not know anything of either language. This melody of the languages becomes so impressed upon the mind when a language is acquired in childhood and spoken for years, that the impression is never entirely erased, and is

transferred to any new language which may be acquired in later years. As the pronunciation and composition of a language are altered by different localities or nations or races, so also is this melody slightly changed in the same manner, without, however, losing its general character; and thus we find that in English there are different accents, such as the Southern, the New England, the English, the Scotch, and so-forth.

From time immemorial grammarians have divided the sounds of articulate speech into two classes—viz., vowels and consonants; and this division will be retained for the sake of simplicity and convenience in the following description; but be it understood that in reality there is no such class distinction in speech. Startling as this may seem, yet this statement is true, and borne out by experiments and close observation; for if we listen to a speaker we do not hear him pronounce vowels and consonants separately, but we hear separate sounds forming the syllables, which consist of the vowel sounds altered in quality by noises or in duration by the more or less sudden cessation of the sound. Several years ago the author verified this observation by experiments carried on by means of one of Edison's loud-speaking telephone-receivers in the following manner: In the centre of the mica diaphragm was fastened a delicate stylus, made of the end of a swan's feather, the tip of which rested upon the surface of a cylinder covered with smoked paper. This cylinder, being revolved, travelled at the same time from right to left, so that the stylus when at rest would draw a continuous line in the form of a

spiral upon the paper. An assistant at the other end of the telephone line, several hundred feet away, would then speak into a transmitter in connection with the receiver, thus causing the mica diaphragm to vibrate and agitate the stylus, which latter drew a series of curves instead of a straight line upon the smoked paper. In the course of the experiment it was found that each of the five elementary vowels gave a distinct curve, which, although altered by the admixture of the consonants in the pronunciation of a syllable, still retained its characteristics. In those syllables in which the consonant noise is sounded either before or after the vowel sound, as in "as" and "saw," the irregular *s* curve was seen to merge into and mingle with the regular curve of "ah," either at its beginning or end, thus giving the vowel sound its peculiar character as heard when these syllables are pronounced.

Recently, Dr. Harrison Allen has made some experiments to determine the action of the soft palate in articulate speech, and has by an ingenious method succeeded in obtaining tracings of the motion of this organ. The curves which he obtained, and which are produced by the vibration of the velum transmitted to a long lever, one end of which rests upon the upper surface of the palate, while the other end projects from the nostril and touches the smoked paper, give only the upward motion of the organ, and are therefore incomplete; yet they also show to some extent this admixture of consonant and vowel sounds with the preservation of the vowel characteristics. And, finally, Prof. E. W. Blake obtained similar curves, showing the composite character of

the sounds of articulate speech by photographing the vibrations of the telephone diaphragm by means of an ingenious method which he describes in *Silliman's Journal* for July, 1878.

The Vowels.—The vowel sounds are those sounds of articulate speech which are primarily produced by the vibration of the vocal cords, the character of the sound being modified in a definite manner by the resonant cavities. Thus, the vowel sound *Ah*, as in "father," is produced by the sound of the vocal cords, and this sound is modified by the peculiar position of the different parts forming the resonant cavities, in such a manner that the ear of the listener recognizes the sound as the vowel *Ah*, no matter whether the pitch of the sound of the vocal cords changes from high to low, or remains stationary. It is not the position of the sound of the vocal cords in the musical scale which distinguishes one vowel from another, but the peculiar quality given to it by the resonant cavities. That this is so, is proved by the investigations of Donders, Helmholtz, Wolff, Seiler, and others, who all agree that in the production of vowel sounds the resonant cavity of the mouth and pharynx is tuned to a definite pitch, which never varies more than a fraction of a tone for the same vowel. And it has also been found that no matter whether the vowel is pronounced by a full-grown man, a child, or a woman, or even by members of different nations, the pitch of the resonant cavity is the same in all instances, provided, of course, that the vowel sound is the same. The discrepancy in the size of the cavity in the several instances is equalized by the greater or less degree of

the opening of the mouth, so that the small oral cavity of the child can be tuned to the same pitch as that of the larger one of the man. The reader can verify this by experiment in the following manner: Let him pronounce in a whisper the vowel sound of *OO*, and while doing so, let him tap his cheek with a lead-pencil; he will then obtain the pitch of the resonant cavity. Let him now change the pitch of this cavity by opening or closing the lips, and then whisper again, and he will at once find the character of the vowel to be changed so as to approach that of another vowel.

This tuning of the resonant cavity to a definite pitch determines the character of the vowel sound by favoring the development of some of the overtones of the vocal sound, while it makes the sounding of other overtones impossible; and, as it has been shown above that the character of the sound depends upon the shape of the wave which is produced by the addition of the overtones to the fundamental tone, it follows that if only certain overtones are added, to the exclusion of all others, the resulting wave will have always the same shape, and the sound always the same character.

The fact, as shown by the experiment, that a change in the tuning of the resonant cavity changes the character of the vowel sound so as to approach to that of another vowel, leads us to think that all the vowels are but modifications of one elementary vowel. The elder Du Bois-Raymond already recognized this fact, and determined upon the *Ah* as the elementary vowel, from which all other vowels are derived. He took this vowel sound as the founda-

tion, because it is the natural result of the vibration of the vocal cords in connection with a resonant cavity, in which there are no obstacles to the even outflow of the sound. In other words, the parts of the resonant cavity remain in a quiescent state, as in normal respiration, and the lips are widely separated, so that a funnel-shaped tube, extending from the glottis to the lips, is thereby established.

Fig. 40.

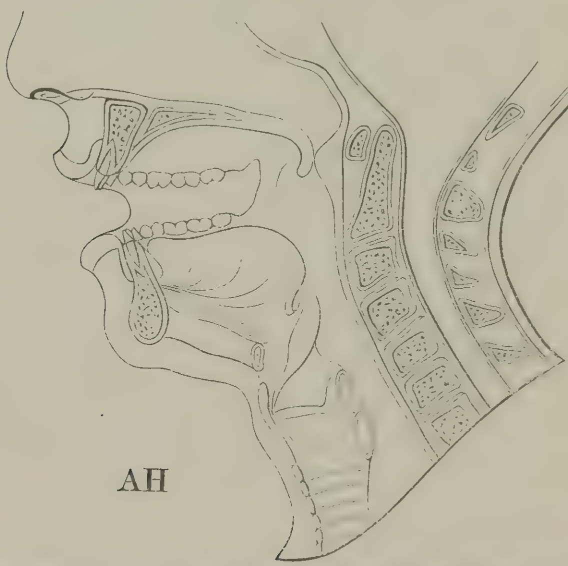


Diagram of vocal apparatus during the pronunciation of the vowel *Ah*.

In referring to Fig. 40, which is a diagrammatic outline of the resonant cavities, and of the larynx in section, it will be seen that in the pronunciation of the vowel *Ah* the tongue lies flat on the floor of the mouth, the teeth and lips are parted, the velum palati, with its uvula, touches the projection in the pharynx formed by the pharyngeal constrictor mus-

cles, and thereby closes the opening leading to the nasal cavities, and the larynx is slightly raised in the throat. The pitch of the resonant cavity stands at about the middle between the other simple vowel sounds, and is the $d\flat^2$ of the musical scale.[1]

The vowel sound *O* is produced by approximation of the lips, so that the opening between them becomes smaller than in the pronunciation of the *Ah*, and at the same time is circular. The tongue rises at its root, and its tip is retracted from the teeth, so as to make the anterior portion of the oral cavity as roomy as possible. These changes would indicate that the pitch of the resonant cavity is lower than in *Ah*, and by experiment is found to be for *O* $a\flat^1$.

The pitch is still lower in the vowel *OO*, because in the formation of this sound the lips are brought together so as almost to touch each other, and are slightly protruded, thus forming a narrow oval opening to the oral cavity, the tongue remaining in nearly the same position which it took in the formation of the *O* sound, so that the lowering of the pitch is produced solely by the diminution in the opening formed by the lips. The pitch of the resonant cavity in the pronunciation of this vowel is *f*.

These three vowel sounds—viz., *Ah*, *O*, *OO*—are called the dark vowels, and the consonant *c* is in most languages pronounced as *k* when either of them follows it in a word or syllable.

Starting again from the *Ah* as the normal vowel, we find that when the lips and teeth are brought

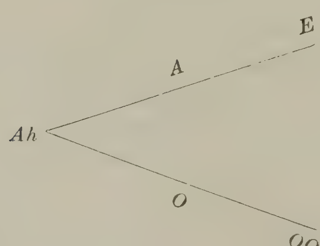
[1] The figures above and below the letters denoting the tones in the musical scale indicate the octave on the piano in which the tone is found, so that the middle C is written *c*, while the octave above is written c^1. The lower octaves are written with capital letters, thus, C_1, C_2, C_3

somewhat closer together, and the sides of the tongue rise until they come in contact with the roof of the mouth, the vowel sound *A*, as in "scale," is the result, and that the pitch of the resonant cavity is raised to $b\flat^2$.

The vowel sound of *E* is formed by a slightly greater approximation of the teeth and lips, the corners of the mouth being at the same time drawn slightly downward, while the tongue rises still more at its edges, touching the palate to such an extent at either side as to leave but a narrow gutter in the middle, by which the anterior and posterior portion of the resonant cavity can communicate. The pitch of this vowel sound corresponds to the $b\flat^3$ of the musical scale, and is the highest of all these vowel sounds. The velum palati is in contact with the ridge formed by the constrictor of the pharynx, and thus closes the posterior opening of the nasal cavity in the formation of these vowel sounds.

The *A* and *E* sounds are termed the light vowels, and before them the *c* is pronounced as *s*.

The relation which these sounds bear to each other can be illustrated by a diagram in the form of a wedge, thus:



The *Ah* sound forms the centre or angle, and as the normal vowel is the starting-point, the light vowels, being of higher pitch, rise above it on the upward plane, while the dark vowels, being of lower pitch, are placed on the downward plane. The *OO* and *E* sounds are the termini, while the *A* and *O* sounds stand between them and the *Ah* sound. It can readily be seen, however, that the qualities of these elementary vowel sounds can be combined, thus forming a new sound, which is called the double vowel, or "diphthong," which is so largely used in the Germanic languages. But other combinations may also be formed, in which the characteristics of the component sounds are not equal, and the one or the other is predominating, as is the case with the *Ah* sound in many English words, so that some grammarians describe as many as twenty vowel sounds in the English language. They can, however, all be reduced to the five elementary vowels described above, and need not here be considered in detail.

The Consonants.—As has already been indicated, the consonants are the more or less distinct noises which, in articulate speech, accompany the vowel sounds, and with them make up the syllables and words. Grammarians have classified them generally according to the anatomical parts of the organs of speech by means of which the noise is produced, as, for instance, into labials, dentals, linguals, and so-forth; but it seems more logical to follow the classification proposed by Dr. Wolff—viz.:

1. Simple self-sounding consonants, which can be sounded and heard without the aid of the vowels

making an audible noise. These are the *C*, *K*, and *G*, *P* and *B*, *D* and *T*, *F* and *V*, *S*, *J*, *R*, and the *Th* sounds.

2. Compound self-sounding consonants, as the *Sh* and *X*.

3. The simple tone-borrowing consonants, which borrow their sound from the vowel, and are audible only in connection with a vowel sound, as *H*, *L*, *M*, *N*.

4. The compound tone-borrowing consonants, which class contains only two—the *W* and the *Ng* sounds.

These noises are produced by a more or less complete obstruction to the outflowing current of air, which obstruction takes place in the oral cavity in three principal places: First, by the application of the tip of the tongue to the upper incisors; second, by the application of the back of the tongue against the velum palati; and, third, by the closure of the lips.

These methods are illustrated by the diagrams in

FIG. 41.

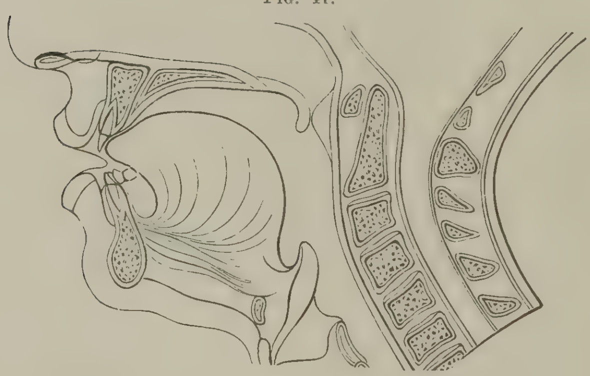


FIG. 42.

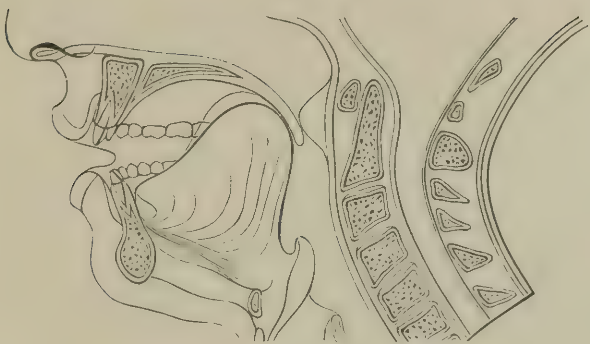
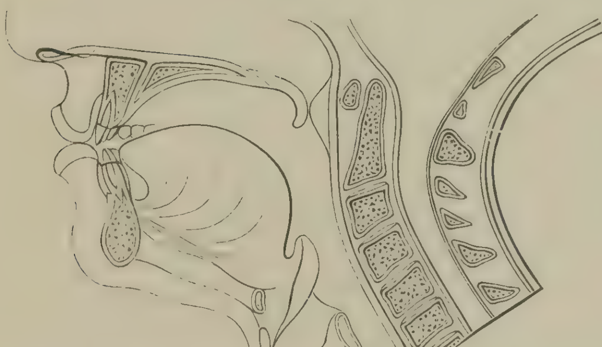


FIG. 43.



Diagrams of the method of producing obstruction to the air current in the pronunciation of consonants.

Figs. 41, 42, and 43. It will be seen that the oral cavity still retains its resonant quality; in other words, sufficient room is left either before or behind the obstruction in the oral cavity for a considerable quantity of air, which, by being thrown into vibrations, gives the consonant a pitch which is independent of the pitch of the vowel and the vocal cords,

and which never varies in the same consonant. In fact, in the self-sounding consonants, in which the noise is quite loud, this pitch can readily be determined by the unaided ear when the consonant is whispered.

The mechanism of the production of these consonant sounds is quite complicated, and it will be necessary to describe it for each sound in detail.

1. *The simple self-sounding consonants.* The *P* and *B* sound is formed by the outflowing current of air meeting with an obstacle presented by the closed lips. The teeth are slightly separated, the tongue lies quiescent in the floor of the mouth, and the velum palati is applied against the wall of the pharynx, thus closing the nasal cavity. The air-current, being confined under pressure in the oral cavity, will give rise to the explosive sound of the consonant when the lips are suddenly parted, or if the consonant occurs at the end of a syllable or word when the lips are suddenly closed. The difference between the *P* and the *B* sound consists in greater air-pressure and more sudden opening or closing of the lips in the formation of the *P* than when *B* is pronounced. This also gives rise to a slight variation in the pitch of the tone to which the cavity of the mouth is tuned, so that the pitch for *P* is $f=346$ vibrations in the second, and that of *B* is $e=320$ vibrations.

In the *K* and *G*[1] sounds the closure of the oral cavity is produced by the back of the tongue, which

[1] The *g* is the co-called "hard *g*," as it is pronounced before the dark vowels, *a, o, u.*

rises until it comes in contact with the velum palati; which latter is in contact with the pharyngeal wall. Both the teeth and lips are slightly parted, and the explosive sound is produced by the more or less sudden application of the tongue to the velum. In the pronunciation of the *G* the tongue touches a larger area of the velum than is the case in the formation of the *K* sound. At the same time, the air-pressure in the *G* is not as great, nor the impact of the back of the tongue against the top of the palate as sudden, as it is in the *K* sound. This, as in the case of the *P* and *B*, produces a slight difference in the pitch of the sounds, which for the *G* comes close to $d^2=582$ vibrations; while that of the *K* lies nearest to $c\flat^2=614\frac{1}{2}$ vibrations.

The third method of producing an obstruction in the oral cavity to the outflowing air-current is utilized in the formation of the *T* and *D* sounds, where the tip of the tongue, as well as its edges, are applied closely to the alveolar border of the upper jaw, and somewhat beyond it against the hard palate. The lips and teeth are again slightly parted, and the air-current is more or less suddenly interrupted, which, as in the case of the foregoing consonant sounds, produces the difference between the two sounds. The pitch of the *D* sound lies nearest to $f\sharp^2=726$ vibrations; while the *T* sound approaches the tone $g^2=776$ vibrations. Here, again, we notice the difference in the pitch of the proper tone of the consonants produced by the greater or less air-pressure.

In the formation of the *F* and *V* sounds the under lip is gently laid against the edge of the upper

incisors, the tip of the tongue pressed against the inner surface of the lower incisors, and the middle portion of its edges is applied to the posterior portion of the alveolar border of the upper jaw, while the velum, as in the foregoing sounds, closes the posterior nasal orifice by pressing against the wall of the pharynx. By this arrangement of the parts a gutter is produced for the flow of the air-current, which is thereby directed toward the closure produced by the under lip and upper incisors. This closure being, however, capable of but little resistance, the air forces its way through, and sets the edges into irregular vibrations, and thus produces the *blowing* sound of *F*. The proper tone or pitch of this sound is very close to $a^2=864$ vibrations. A more gentle flow of the air-current through the gutter and past the obstruction produces the *V* sound the proper pitch of which cannot be accurately determined, owing to the want of loudness of the tone and presence of many of the higher overtones; but, judging from analogy, its pitch should be about a half tone lower than that of the *F*.

Similar to the *F*, the *S* sound is formed by a continuous flow of breath past an incomplete obstruction, the edges of which are set in vibration. So we find that in the pronunciation of the *S* the teeth are brought almost in contact with each other, leaving a narrow slit between them; the lips are slightly parted, the tip of the tongue rests against the inner surface of the lower incisors, and its edges are pressed against the whole length of the dental arch of the upper jaw, thus forming again a gutter between its middle and the palate. The velum closes

the posterior nasal orifice to prevent the escape of the breath through the nose. The pitch of this sound, on account of the small space of air in the oral cavity, is very high, corresponding to $b\flat^4$=3666 vibrations per second. The description of the formation of the *S* sound comprises in itself, as a matter of course, the *Z* and the *C* when placed before the light vowels *E* and *I*, which differ from the *S* only in the greater or less force of the outflowing breath.

The *J* sound also comprises several consonants—viz. the *Ch* and *G* sound when placed before the light vowels—and differs from it only in the greater or less force with which the air-current is driven past the obstruction. The *J* is formed by the anterior portion and the edges of the tongue being laid gently against the palate and the alveolar borders of the upper jaw; the lips are parted, the teeth are slightly separated, and the velum pressed against the pharyngeal wall. In this way, again, a gutter is formed for the breath to flow through, which ends on a line slightly back of the cuspid teeth, and the air has to force its way between the palate and the anterior portion of the tongue. The pitch of the proper tone of this sound is, as in the *S* sound, very high and approaches closely to d^4=2328 vibrations.

Closely resembling the *S* sound in many ways is the *Th* sound, which is formed by the tip of the tongue being pushed out between the incisor teeth, while its edges are applied to the alveolar borders of the upper jaw, forming again the channel for the direction of the air-current, which is prevented from escaping through the nose by the velum being pressed against the pharynx. The lips are parted

to give free egress to the air after it has passed the obstruction presented by the tip of the tongue and the upper incisors. The breath as it passes this obstruction causes a slight irregular vibration of the edges of the teeth, which gives rise to the blowing sound which is so difficult for foreigners to acquire. The pitch of the proper tone of the *Th* sound is about a tone lower than that of *J*, and corresponds to the c^4=2112 vibrations per second.

The last of this class of consonants is the *R* sound, which, however, differs from all other consonants, inasmuch as it can be produced in two different ways. Almost all English-speaking people pronounce this consonant with the back of the tongue, but so indistinctly that it is barely audible, while the *r* in most other languages is made with the tip of the tongue and is quite audible as a self-sounding consonant. The first is called the "guttural *r*," while the other, the correct sound, is termed the "lingual *r*."

The "guttural *r*" is produced by the back of the tongue being placed gently against the velum in the same place as in the *G*. The posterior nasal orifice is closed by the velum, and the uvula is allowed to hang down and lie on the tongue. The current of air is then forced past the incomplete obstruction, and in doing so the uvula is thrown into slow, irregular vibrations, which produce the peculiar fluttering sound. The pitch of the proper tone of this sound is near the C_3=16½ vibrations, the lowest tone which the ear is capable of distinguishing as such.

The "lingual *r*," on the other hand, is produced by the tip of the tongue being brought close to the

anterior portion of the palate, without, however, quite touching it, while its edges are applied against the alveolar borders of the upper jaw. Thus a gutter is formed, as in some of the foregoing consonant sounds, and the air-current, being directed against the tip of the tongue, throws it into slow vibrations, whereby the "rolling" sound of the "lingual *r*" is produced. The pitch of the proper tone of this consonant is near to $C_2 = 33$ vibrations; *i. e.* one octave higher than the "guttural *r*."

2. *The compound self-sounding consonants.* This class comprises the consonants which really are a combination of two of the sounds belonging to the first class, and in the English language but two sounds are comprised in it—viz., the *Sh* and the *X*.

In the *Sh* two obstructions are in the oral cavity, through which the air-current has to pass. The one is produced by the tongue being almost in contact with the middle of the palate, as in the *J* sound, while its edges are firmly pressed against the alveolar borders of the upper jaw; and the other by the teeth being brought closely together, leaving but a narrow slit between them, as in the *S*. In this way the two compound sounds are merged into one, modifying each other so as to result in the "rushing" sound of the *Sh*. On account of the combination of these two sounds, there are noticed two proper tones in this sound, the one produced by the vibration of the air contained in the cavity of the mouth, and the other by the vibration of the edges of the teeth. To a trained ear a third tone is also appreciable, which is the so-called "resultant" tone, pro-

duced by the combination of the two first tones.[1] The pitch of the first of these tones is nearest the $d^4=2328$ vibrations; of the second, nearest the $b\flat^4=3666$; and of the resultant tone, nearest the $f^3=1378$ vibrations.

The *X* is a combination of the *S* and the *K* sounds, and is formed like these, the tongue pressing against the velum palati with its back, forming the gutter with its middle, and directing the air-current through the narrow slit between the teeth. The proper tones also are double, as in the *Sh* sound, but a resultant tone cannot be heard. Their pitch is that of the *K* nearest the $c\flat^2=614\frac{1}{2}$, and that of the *S*, nearest the $c\flat^4=3666$ vibrations.

3. *The simple tone-borrowing consonants.* The consonants belonging to this class can be heard only in connection with a vowel, and because in their formation an obstruction to the outflowing air-current does not take place, and the breath is emitted noiselessly and without effort. For this reason also no proper tone, the pitch of which could be determined, is heard.

The first of these consonants is the *H*, an aspirate, which in some languages is not even accorded a place among the letters of the alphabet, but is designated by a sign; as, for instance, in the Greek. This consonant consists in the somewhat forcible exhalation of the breath through the perfectly unobstructed oral cavity, which assumes the shape of the

[1] An explanation of the combination and resultant tones would lead us too far into the science of acoustics, and the reader is referred to any of the text-books on physics for a detailed description of this phenomenon.

vowel in connection with which the *H* is pronounced, or, if whispered, the cavity has the shape which it assumes in the formation of the vowel *Ah*. The posterior nasal orifice is, of course, closed, to allow the air to flow through the mouth.

The *L* is formed by the tip of the tongue being placed against the anterior portion of the palate and the internal surface of the upper incisor teeth, while its edges lie flat within the body or the floor of the mouth. The teeth and lips are parted and the velum palati applied to the pharyngeal wall. This arrangement allows the breath to flow gently through the two large openings left between the edges of the tongue and the upper teeth on either side of its tip. In the whispered *L* no proper tone is heard, but as soon as a vowel is sounded after it, a tone is heard which comes close to that of the vowel *E*, and for this reason the *L* is considered in some languages as a semi-vowel, and is frequently interchanged with the *E* sound in the Romanic languages; as, for instance, in the Latin word *flos*, which is changed into *fiore* in Italian.

In the *M* the organs of articulation are in a position of absolute rest; that is, the tongue, lips, teeth, and velum are in the position which they assume in ordinary breathing through the nose. In consequence, no sound is heard when it is attempted to whisper; the consonant and its characteristics are only brought out when a vowel sound accompanies it; and even then the vowel sound must be made with the lips closed and the posterior nasal orifice opened, letting the sound escape through the nose before or after the vowel itself is pronounced, according to

the position of the *M* either before or after the vowel.

The formation of the *N* is, in all respects but one, identical with that of the *M*, and the difference between the two consonants consists in the fact that in the *M* the oral cavity is closed by pressing the lips together, while in the *N* the closure is made by the tip and edges of the tongue being applied to the alveolar border of the entire upper dental arch and the enlarged area of the palate.

4. *The compound tone-borrowing consonants.* This last class of consonants contains but two sounds, the *Ng* and *W*, which are in reality combinations of two consonants. Thus, the *Ng* is a combination of the *N* and the *G*, inasmuch as the oral cavity is closed by the back of the tongue being applied to the velum palati, as in the *G*; and the air is allowed to escape through the nose, as in the *N*, the posterior nasal orifice being left open for that purpose. As in the *N*, no sound, except perhaps the forcible expiration through the nostrils, is heard when the *Ng* is whispered, and it can only assert itself in connection with a vowel.

The same is true of the *W*, which is a combination of the *H* and the *V*, and differs in its formation from the *H* only in the lips being brought closer together and allowing the breath to escape through a slit-like opening between them. As in the *H*, the nasal cavity is separated from the rest of the resonant cavity by the velum palati being again pressed against the ridge formed by the constrictor of the pharynx.

THE PHYSIOLOGY OF THE NASAL CAVITIES.

Like the larynx, so also do we find that the nose performs the functions which are of very great importance, and which should be thoroughly understood by the student of rhinology. For it is the disturbances of these functions which give rise to the many, and often obscure, symptoms which we notice in connection with the diseases of the upper air-passages.

The first of these functions is to give the most advantageous position for the terminal fibres of the olfactory nerves in the upper portion of the anterior nasal chambers, where a portion of the expired air has access to them, and where they can be excited by the minute odoriferous particles floating in the air. Inasmuch as the sense of smell is not so much one of gratification, but one of protection, by means of which deleterious substances or dangerous gases may be perceived, and thus avoided, the entrance to the air passages is certainly the most advantageous place in which to place the sentry who is to give the alarm. Besides being the seat of the sense of smell, the nose, by its second function, aids materially in voice-production and articulation, which function has, however, already been described in the foregoing pages, and it is, therefore, not necessary again to consider it in detail. Suffice it to say that the reader can readily satisfy himself of the importance of the nose in speaking, if he will close both nostrils while articulating, and observe the effect upon his voice; or, if he possesses sufficient power over the movements of his soft palate, let it hang down so as to

allow the air to pass through the nose while speaking. In both cases, a so-called *nasal* voice will be the result, which is due to the absence of nasal resonance.

The third function, perhaps the most important of all, is the preparation of the air prior to its introduction into the larynx, trachea, and lungs during the act of inspiration. By the bristle-like hairs called vibrissæ which are situated in the vestibule, all the coarser particles of dust floating in the air are arrested, while the finer particles which pass through this sieve are caught by the glutinous mucous secretion covering the normal nasal mucous membrane, so that in its passage through the nose the air is purified from all foreign bodies. Further, the anatomical relation of the turbinated bones to each other and to the septum presents a very large surface over which the air must pass in nasal respiration, and on account of the erectile tissue overlying the turbinated bones the warm arterial blood is brought very close to this large surface. In consequence, some of the heat from the arterial blood is radiated from the mucous membrane and the inspired air is raised in temperature. This temperature difference has been estimated to average 2° F., but much depends upon the temperature of the external air, for the colder it is the greater will be the amount of heat absorbed by it in its passage through the nose, while in summer hardly any difference in the external and internal temperature of the inspired air is noticeable.

And finally, in consequence of the watery secretion of the serous glands, and also through the outpouring of serous fluid into the nasal cavities by the osmotic action of the lining mucous membrane, the

amount of which is estimated by Bosworth to be from fourteen to sixteen ounces in the twenty-four hours, the inspired air is moistened almost to the dew-point, so that, in its passage through the larynx, it does not dry up the mucous membrane. The surplus of this large quantity of fluid which is not taken up by the air, passes imperceptibly down through the pharynx into the œsophagus and stomach in man, but in most animals, particularly in the ox and the dog, it runs out of the nostrils, where it evaporates and produces the proverbial coldness of the nose when the animal is in good health.

It will thus be seen, that the main function of the nose is to aid in respiration, and that it is an important respiratory organ, for, as will be described later on, any interference with the proper preparation of the air for its introduction into the respiratory tract gives rise to disturbances throughout this whole tract. It will also be seen that, although the mouth may supply, to some extent, the place of the nose as the respiratory orifice, yet it cannot do so perfectly, and the pharynx, larynx, and trachea soon become irritated by the passage of the dry, cool, and dust-laden air and the inspirations become more shallow, showing also irritation of the bronchi and bronchioles. A very few words will suffice for a description of the functions of the pharynx, that intermediate cavity, or rather tube, between the nose and the larynx and œsophagus. It is simply a passage-way to conduct the air from the nose to the larynx during respiration, and guides the food into the œsophagus during deglutition. In its character as a portion of the resonance apparatus in phonation, it has already been considered.

CHAPTER V.

INSTRUMENTS ACCESSORY TO LARYNGOSCOPY AND THE TREATMENT OF LARYNGEAL DISEASES.

Having described the laryngoscope, the different modes of using it, and the appearances of the normal laryngeal and rhinoscopic images, it remains to describe some instruments which, in connection with the laryngoscope, are used for making further exploration of the parts by the sense of touch and for making application to the diseased mucous membrane of the throat and nose. The instruments used for the extraction of foreign bodies and the removal of neoplasms, as well as for the performance of other operations within the cavities of the throat and nose, will be treated of under their respective heads.

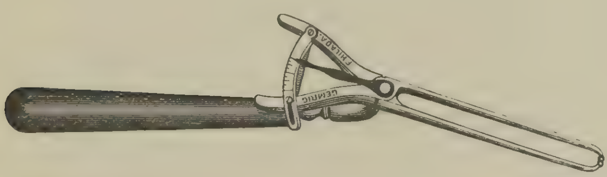
The Laryngeal Sound.—The eye is frequently unable to determine certain conditions seen in the laryngoscopic mirror, and others seen without it in the pharyngeal and nasal cavities. Hence the sense of touch aiding that of sight is frequently necessary in order to form a correct opinion as to the condition of the parts. For this purpose in laryngoscopy, as in surgery, a sound is employed.

The laryngeal sound consists of a piece of silver wire rounded off at the end, and held in a mirror handle. It should be flexible, so that any desired

curve can be given to it, but should be stiff enough to resist a considerable amount of pressure before yielding, and it should be long enough to reach to the anterior angle of the glottis without bringing the fingers holding the handle into the mouth of the patient, and thus obstructing the view. By means of the sound, attachments of tumors, depths of ulcers, etc., are determined.

The Septometer.—It is often difficult, if not impossible, to determine with the eye or sound alone, whether a bulging of the nasal septum to one side

Fig. 44.



Septometer for measuring thickness of nasal septum.

or the other is due to a bend or deviation from the normal position, or whether it is due to localized thickening of the plate. This may be ascertained by means of the author's septometer, an instrument similar to the one used by mechanics to determine the diameter of a piece of wood or iron being turned in the lathe (Fig. 44). In using it the long straight shanks are introduced, one in each nostril, and being closed upon the septum the rounded points are gently moved up and down, and backward and forward over the bulging portion of the septum. The motion of the index attached to the curved shanks of the

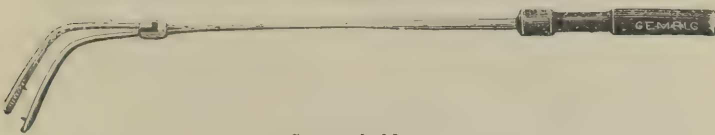
instrument accurately indicates the *relative* thickness of tissue grasped between the points in the nose. By means of this instrument we can thus ascertain whether we have to deal with a deviation or a localized thickening of the septum, for if it is a deviation the index will move but slightly, while it will travel a considerable distance when the points pass over a thickened portion.

Sponge-holder.—Most remedies employed as applications to the mucous membrane of the throat and nasal cavities are used in solution. They may be applied either with a sponge, a tuft of cotton, a brush, or as a finely subdivided spray.

A small piece of fine sponge tied securely to the end of a bent silver wire or sound, and dipped into the solution to be used, can be carried to any desired spot in the larynx, pharynx, or nasal cavities. This constitutes what is called a sponge-holder. As it is necessary to renew the piece of sponge with every application, it is more convenient to employ an instrument made for the purpose, to which the piece of sponge can be quickly and securely fastened. The already-described epiglottis forceps may with advantage be employed for this purpose. A piece of wire bent to the proper curve, split at the end, and secured in a wooden handle, is, however, generally used as a sponge-holder. A sliding ring slipped over the split end serves to approximate the two halves, thus securely holding a piece of sponge between them (Fig. 45). The sponge should be small, only large enough to cover the ulcer or abrasion, to which *alone* it is to be applied. The old-fashioned whalebone probang, with a large piece of

rough sponge tied to the end, is altogether unfit for any application to the delicate mucous membrane of the throat.

Fig. 45.



Sponge-holder.

Cotton Applicator.—When applications of liquid are to be made to lesions in the pharynx or the nasal cavities, it will be found that a tuft of absorbent cotten attached to the roughened end of a silver or aluminium probe is often preferable to the sponge, because the closer texture of the cotton holds the liquid better, and there is less danger of a drop becoming detached during the application and running down, causing irritation. The cotton should be wound around the end of the probe in such a manner, that by a little twist of the fingers it can be detached after the application has been made. If, however, it adheres so tightly to the probe that it cannot be easily pushed off, the simplest way to get rid of it is to burn it off by holding the end of the probe carrying the cotton over the lamp, and allowing it to become charred, when it can readily be wiped off. For applications to the anterior nasal cavities I am in the habit of using the ordinary wooden toothpick as cotton carriers, and throwing them away after having made the application, thus saving time and trouble.

The Brush.—In many cases a soft camel's-hair brush, securely fastened to a *stiff*, curved stem, may

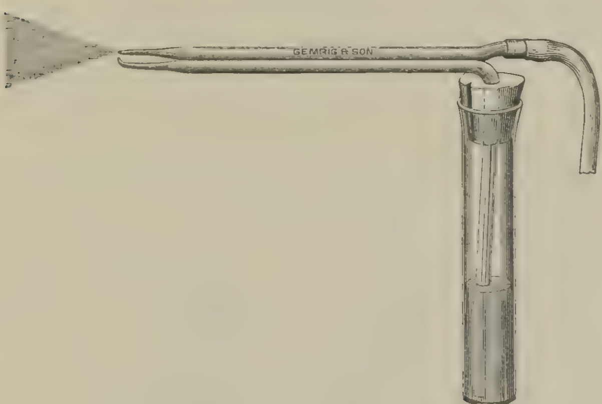
be advantageously employed for touching ulcers or abrasions in the pharynx and larynx. The brushes should be mounted in a cap of hard rubber, which can be screwed to the end of a silver laryngeal probe. Frequently, brushes are sold mounted in brass caps; these are not to be recommended, as the reagents used for applications attack the brass and loosen the hair, so that single hairs, and even large tufts of hair, come out of the brush, and are apt to remain in the throat of the patient, causing very unpleasant symptoms.

Another kind of brush is sold as a laryngeal brush, which is tied to a slender wire, having loops at the end for a handle. This kind is very unsatisfactory, inasmuch as the stem is too thin and elastic, and consequently it is very difficult, or almost impossible, to touch any desired spot in the larynx or pharynx with the point of the brush.

The Atomizer.—In most forms of throat and nasal disease the application of solutions in the form of a spray is extremely useful, not only with a view to cleanse the mucous membrane of secretions before making applications with the sponge, brush, or cotton pledget, but also as a means of spreading medicated solutions over a larger surface, and of gaining access to parts which can in no other way be reached. This spray is produced by means of an atomizer, of which a large variety, of different degrees of usefulness, may be obtained from the instrument-makers. The best of these are the so-called Sass' atomizing tubes (Fig. 46) made of glass or rubber, and throwing an extremely fine spray, either straight forward, upward, or downward.

They work on what may be called the exhaust principle, in which a current of air being forced through a tube, on passing out from the small opening at the end, rushes past the opening of another tube, the end of which is below the surface of the liquid to be nebulized. In doing so, the current exhausts the air in the second tube, thus causing a rise of the liquid until it appears at the opening, when it is carried along with the current of air in a finely subdivided state.

FIG. 46.



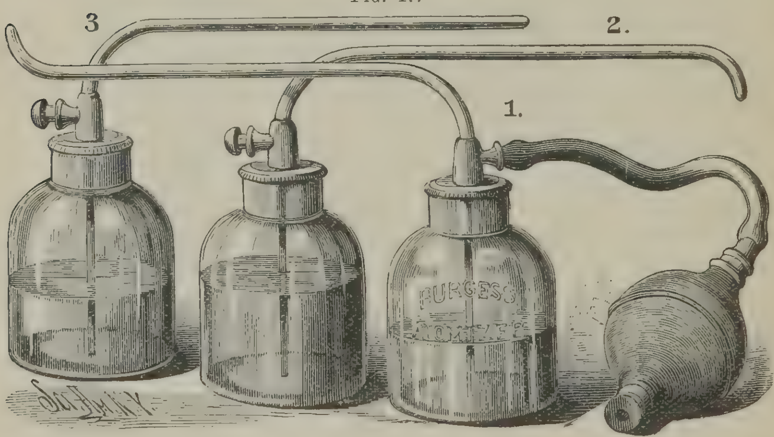
Sass' atomizing tubes.

The current of air may be obtained by means of the well-known rubber-ball pump (see Fig. 47), which, by being compressed in the hand, forces a puff of air through the tube. If a continuous spray is desired (which is the case in most instances), a second rubber ball is connected with the pump ball,

which, acting as a reservoir, stores the air under pressure, thus producing a continuous stream.

Another very good instrument, especially useful for cleansing and medicating the nasal cavities is the toilet or perfume atomizer. This works on what may be termed the principle of compression, in which the air from the rubber bulb enters the bottle containing the liquid, and by its pressure on the surface forces the solution to ascend through the fine tube until it reaches the contracted opening, where, by the friction, it is broken up into a spray. The most commonly used atomizer of this class is the so-called "Magic" atomizer, which answers the purpose admirably, but has the disadvantage that the

Fig. 47.



The Burges' atomizer.

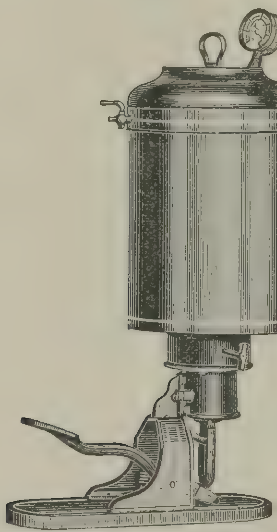
cement with which the cap is fastened to the neck of the bottle very easily becomes loose, and further that the small inner tube being fastened near the

end of the larger tube, is easily detached, rendering the instrument useless. These defects have led to the construction of the Burges' atomizer, made by Shaw & Geary, of Philadelphia, in which the cap of hard metal is screwed to the neck of the bottle, the small tube is securely fastened and the end of the large tube is detachable, affording easy access to both tubes, for the purpose of removing obstructions. Three different kinds of atomizers, of this pattern, are in the market, one straight, one for throwing the spray downward into the larynx, and one for spraying upward into the naso-pharyngeal space. Only one bulb is needed to produce a continuous spray, owing to the perfectly air-tight closure of the bottle and the improved rubber bulb (Fig. 47). Although useful in many instances, this atomizer has its disadvantages. In the first place, the stream is much coarser than that obtained from the Sass tubes, and, secondly, being made of metal, solutions containing salts of iron, copper, or silver, or acids, cannot be used with it, as they would corrode the tube and close its fine opening. Atomizers working on the same principle, made of hard rubber, and with movable tips, enabling the operator to throw the stream in any direction, thus avoiding the objections to the perfume atomizer, may be obtained, but they are so large and clumsy as to be almost useless.

For office use, where the spray is used largely, the working of the hand-ball pump is not only very tedious, but also has the great objection of occupying both hands of the operator, one in holding the atomizer and the other in working the ball, and thus it becomes necessary to have a supply of air

under pressure which can be used at any moment. For this purpose the Burges' blowpipe, to which a large reservoir with pressure-gauge is attached, forms a very convenient and cheap apparatus (Fig. 48). It is composed of a small air-pump, worked by the foot, forcing air into the reservoir, which,

Fig. 48.

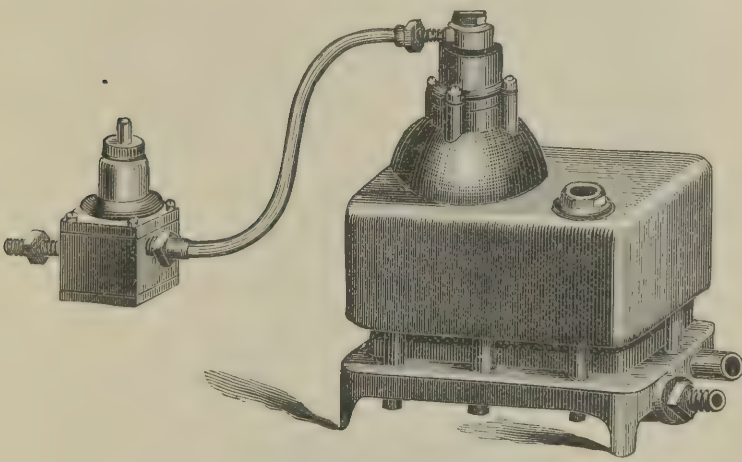


Burges' air-compressor.

when the desired pressure (ten to fifteen pounds, as indicated by the guage) is obtained, should be shut off from the pump by a stop-cock, to prevent leakage through the valve. To another stop-cock at the top of the reservoir is attached a long flexible rubber tube, the end of which is slipped over the end of the air-tube of the atomizer. The stop-cock being opened, the air rushes through the tube and produces the spray, which can be instantly stopped by

bending and pressing the rubber hose against the opening of the air-tube with the hand holding the atomizer, and without the necessity of closing the stop-cock in the reservoir. Thus the operator has

FIG. 49.

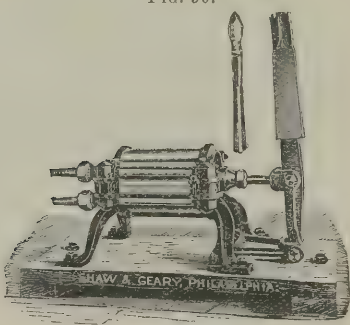


Water air-pump.

perfect control over the instrument with one hand, and is free to hold the tongue of the patient or manipulate the nasal speculum with the other. The air used from the reservoir must be replenished by pumping as the pressure diminishes. By means of a very ingenious air-pump (Fig. 49), worked by a stream of water this inconvenience is obviated, for the apparatus always keeps a certain pressure in the receiver. A regulator which is attached to it enables the operator to set the pump so that there are always, say, fifteen pounds of pressure in the receiver, and when this has been obtained the

pump automatically stops work, to begin again immediately as soon as the pressure has diminished in the reservoir. It can be attached to any stationary washstand, and will give as a maximum the pressure of the water in the hydrant pipe, which is usually from fifteen to twenty pounds. Of course, any kind of air-pump and reservoir will answer the purpose as long as the necessary air-pressure can be obtained and controlled at the will of the operator (Fig. 50).

Fig. 50.



Double-acting air pump.

In the office the physician will find it most convenient to attach the hose conducting the air from the condenser, attached to a metal tube, in which are inserted a number of small stop-cocks, to which, in turn, are attached flexible rubber tubes leading to the atomizers which are placed on a shelf near at hand. If a pressure of not more than fifteen pounds is used in the reservoir, and the rubber tube is of good natural black rubber, the pressure of the thumb against the nipple of the atomizer is sufficient to control and cut-off the air supply, and as, in most cases, a greater pressure than fifteen pounds is

rather harmful, this natural thumb cut-off is the most convenient and satisfactory. When, however, more pressure is required, and when the tubes are of stiff white rubber, a mechanical cut-off is needed for regulating and cutting off the air supply. These cut-offs are nothing more than a valve made in such a shape as to be convenient for the hand, and they have the advantage that no air enters the atomizer unless pressure is made upon the thumb-piece, thus allowing greater freedom of manipulation than is possible when only the natural thumb cut-off is used.

When the spray application is to be made frequently at the house of the patient, and especially when it is to be long continued, the steam atomizer (Fig. 51) is the most serviceable instrument for the

FIG. 51.

Steam atomizer.

purpose. It, like the Sass' tubes, acts on the exhaust principle, but instead of using a current of air to nebulize the liquid, steam from a small boiler,

to which the air-tube is attached, supplies the necessary force. The stream of atomized liquid cannot, however, be directed to any particular part, and the patient must draw it into his larynx during the act of inspiration. In order to protect his face from the moisture the spray is directed through a sort of funnel, the narrow end of which the patient holds in his mouth.

Liquids containing gums or resins cannot be used in atomizers, because they clog the fine opening of the tube. As they are mostly volatile in a greater or less degree, they may be employed to advantage for inhalations in a different way.

Vapor Inhalations.—The simplest, but nevertheless a very effective, method of using resinous liquids containing volatile ingredients is to mix them with hot water in a tumbler or cup, over which the wide end of a funnel or paper cone is placed, while the vapor rising from the mixture is inhaled by deep inspirations from the narrow end of the funnel or cone. Another convenient method for hot inhalations, is to place the mixture of hot water and resinous liquid in a small earthen teapot so that the level of the liquid is below the natural opening of the spout. The lid of the teapot is replaced and the vapor inhaled with deep inspirations, by taking the end of the spout in the mouth.

A more convenient instrument for such inhalations is the so-called inhaling bottle, a wide-mouthed vial holding from four to six fluidounces. Its air-tight-fitting stopper of cork or rubber is perforated by two holes, each admitting a glass tube, one of which is straight, and long enough to reach from

the top of the stopper to within a fraction of an inch of the bottom of the bottle; the other tube is slightly bent, and is pushed through the stopper until its lower end just protrudes below the under surface, the other end projecting several inches above the upper surface of the stopper. When it is to be used, the bottle is half filled with hot water, and a little of the resinous liquid is added to it. The stopper with the tubes is then replaced, and a deep inspiration is drawn through the bent tube. This causes a tendency to a vacuum in the bottle above the surface of the liquid, and a consequent rush of air through the straight tube, which, on reaching the bottom of the vial, bubbles up through the liquid and becomes impregnated with the volatile substances.

By inserting a small homœopathic vial in the stopper, and bending the upper end of the long tube in the form of a hook, so that the opening of the tube fits over the opening of the small vial, the bottle can also be used for the inhalation of the fumes of muriate of ammonium. In order to obtain the latter, the large bottle is half filled with cold water, to which a few drops of strong aqua ammonia are added. The small vial is half filled with chemically pure hydrochloric acid. By exhausting the air in the bottle, the atmospheric pressure causes the fumes of the acid to pass down the tube and up through the ammoniated water. Combining with the ammonia the acid forms the muriate of ammonium in the state of dense white vapor. In many instances where hot water is not easily procured, it is of advantage to have an apparatus for hot inhalations, in

which the water can be heated on a gas flame or spirit lamp. For this purpose the author, several years ago, devised an inhaler composed of a small tin can, the lid of which is conical, in the shape of a funnel, and has inserted in the rim a tin tube reaching to the bottom of the can. The opening in the funnel-shaped lid ends in a short tube, over which is slipped a short piece of rubber tubing, with a mouth-piece attached to its free end. In principle, it is the same as the inhaling bottle, but is less easily broken, and has the advantage that it may also be used for dry inhalations (Fig. 52).

Fig. 52.

The Author's universal inhaler.

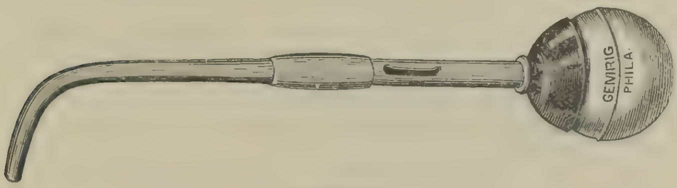
In certain cases of spasmodic affections of the larynx, the inhalation of the vapors of nitrate of potash is used with very good results. Such vapors may be obtained by burning in a large jar, over which a funnel is placed, or in the author's universal inhaler, a piece of paper which has been soaked in a saturated solution of nitrate of potassa, or other antispasmotics, and then dried.

Insufflator.—Remedies are often applied to the throat in the form of an impalpable powder, and for this purpose an instrument called an insufflator is used (Fig. 53).

It consists of a tube of hard rubber or metal curved at one end, and connected with a soft-rubber ball at the other. Near the ball an elongated opening is

cut into the side of the tube, which may be closed by sliding over it a short piece of another tube. In the improved insufflator now commonly in use, the tube is made in two pieces, which fit into each other, thus forming a continuous tube. The end piece is shaped so that, at the place where it fits into the shorter ball piece, it forms a scoop, with

FIG. 53.



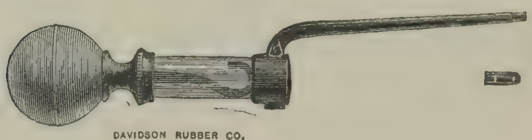
Insufflator.

which the powder is taken out of the box or bottle, and in which it remains until forced out by the air current. When the instrument is to be used, the powder is placed in the tube, and the ball is compressed suddenly, thus causing a puff of air, which carries the powder with it.

For office use I have devised a reservoir insufflator, which I have found very convenient. This instrument consists of a small hard-rubber or glass vessel with a stopper containing two holes, one of which admits the tube leading from the ball or air receiver, while in the other is inserted the longer tube intended to emit the powder. The air-tube reaches down to within a short distance of the bottom of the vessel, and is bent at a right angle as it leaves the stopper. To it is attached a rubber ball containing a valve or the rubber tube from the air receiver. The

other tube, also bent at right angles just above the stopper, reaches down but a short distance into the vessel. The portion outside is bent in the curve seen in the ordinary insufflator, when it is to be used to throw powder into the larynx; or it is straight and drawn to a point when it is to be employed for the anterior nares. The tubes being pushed into the hole of the vessel, one can be substituted for the other as

Fig. 54.



Reservoir insufflator.

the case may require. The advantages of this form of insufflator are that as the current of air passes into the reservoir containing the powder it stirs it up and passing out by the other tube, carries with it only the finer particles, while the coarser and heavier ones which might give rise to irritation, remain in the reservoir. It also obviates the difficulty of loading the instrument every time it is to be used. A similar instrument (Fig. 54), perhaps more elegant than the author's, has lately been put in the market, which, in principle, is, however, the same. Instead of having the reservoir at right angles, it is placed in the shape of a glass tube in a line with the rubber ball and the tube, which latter is made to revolve, so that the instrument can be folded up, so to speak.

An insufflator may be improvised by using a piece of glass tube or a piece of stiff writing paper rolled

over a lead pencil, into which the powder is introduced and blown out by the breath of the physician.

The Caustic-holder.—Nitrate of silver, when it is to be applied to ulcers in the larynx or pharynx, in the solid form, should be fused on to the roughened end of a silver probe by holding both the end of the stick of nitrate of silver and of the probe over a lamp, and causing the caustic to melt, when it will adhere to the probe in the form of a drop, which retains its shape on cooling. This method is much safer and more economical than the use of solid nitrate of silver by the *porte-caustique;* because in the latter instrument the piece of caustic is apt to break, and the detached particle to drop into the larynx or trachea. Besides, in order to destroy any infectious material from a specific ulcer, the stick of nitrate of silver has to be washed, whereby a great deal of its substance is dissolved and lost. The probe, on the other hand, has but a thin coating of silver upon its end, which cannot easily break off, and can be readily remelted over the lamp, thereby destroying all infectious material that might cling to it.

CHAPTER VI.

CATCHING COLD, PATHOLOGY OF MUCOUS MEMBRANE, THERAPEUTICS.

Catching Cold.

As most of the diseases of the upper air-passages are caused more or less directly by what is popularly known as catching cold, I will here in a few words

endeavor to explain the meaning of this term before entering upon the consideration of the general pathology of the mucous membrane.

It is a well-known fact that the human organism must be maintained under all circumstances at a temperature equal to 98° Fahr., otherwise disease will result, and that the source of this heat is within the organism, the expenditure of which by radiation we endeavor to minimize by living in houses and by protecting the surface of the body with clothes.

The first part of this proposition is an accepted fact and self-evident, while the second needs some further explanation.

Heat is produced in the animal organism in two ways: first, by oxidation of food, and second, by the conversion of muscular movement into heat, according to the now well-established law of the correlation of forces. How and where this oxidation of food takes place I will not here enter into, but will state that certain articles of food yield a larger amount of heat than others. Thus animal food, and especially animal fats and oils, produce more heat when introduced into the system than farinaceous food and fruits do. This we find exemplified in contrasting the mode of living of the Esquimaux and other inhabitants of the north with those dwelling in the tropics.

The Esquimau lives almost exclusively on animal food and fish oil, while the South-sea Islander, who lives most of the time in an atmosphere the temperature of which is higher than the normal temperature of his body, eats chiefly fruits and vegetables.

And even in temperate climates, where man lives both on vegetable and animal food, more of the former is consumed during the warm season, while the latter is in preponderance during the cold winter months. The Catholic church long ago recognized this fact, and has introduced the lenten season, a period of abstinence from animal food, at a time of the year when the seasons change from the cold to the warm, for if more heat-producing food is taken into the system than is required to keep the body at the normal temperature, the digestive system is taxed beyond its capacity, the blood is overcharged with effete material, which is not eliminated quickly enough, and, as a result, we feel out of health, which, when it occurs during the first warm days of spring, we call spring fever. The same effect is produced when we change our abode from the North to the South during the winter months, and persist in the same mode of living, and take the same amount of animal food; and if we continue to live this way for a length of time, the result is congestion, and may be abscess of the liver. This is exemplified by the fate of so many Englishmen who go to India, where they eat their roast beef and drink their heavy ales, as they have done in England, but who in a few years have to return with a diseased liver, blaming the climate when they should blame themselves.

In order to oxidize the food, oxygen must be introduced into the system in sufficient quantity, through the lungs, otherwise part of the food only is burnt up and produces heat, while the rest is thrown out again as waste material, and by its presence

materially interferes with the normal action of the different organs.

Muscular exercise, as is well known, produces heat within the system by a conversion of motion into heat, but this motion depends for its sustenance upon the contractile force of the muscles, which is kept up by part of the food taken into the system. If this contractile force of the muscles is not exercised, it needs not as much nourishment, and the surplus is deposited as fat within and around the different organs. This is exemplified by the fact that, in order to fatten an animal, it is kept confined within a narrow space and is overfed.

There can be no doubt that sunlight plays an important part in the oxidation of food within the system, and this is probably one reason why night air is generally supposed to be injurious to delicate constitutions.

This heat which is generated within the body by the oxidation of food and by muscular movement, would be lost by radiation if the temperature of the atmosphere surrounding the body was far below the normal temperature of the system, and, therefore, this loss must be minimized by interposing between the integuments of the body and the air non-conductors of heat, in the shape of clothing, not to keep the cold out but to keep the heat in. The face, part of the neck, and the hands are, however, generally exposed, and thereby the epidermis becomes hard and horny, thus becoming a bad conductor of heat, and very little of the systemic warmth is lost by radiation from these parts.

The hygrometric condition of the atmosphere,

irrespective of temperature, has a great deal to do with the temperature of the body, at least as far as individual sensation is concerned. We feel more chilly in a cold, damp atmosphere than in a dry one of the same temperature, and we can endure a greater amount of heat when the air is dry than when it is filled with aqueous vapor. As far as I know, this fact has not, as yet, been satisfactorily explained, and I would suggest, as a reason, that the moisture is absorbed by the skin, thus making it a better conductor of heat and facilitating the ingress and egress of heat through it.

We also minimize the expenditure of animal heat by living the greater part of our time (in cities, at least) in houses and apartments from which the outer air is excluded as much as possible, and the atmosphere of which, during the cold season, is artificially heated.

The maintenance of the normal temperature of the body, therefore, depends upon the production of heat by oxidation of food within the system, by muscular exercise, and upon the prevention, or, at least, reduction, of the radiation; and a lowering of this temperature, especially if it be sudden, causes contraction of the capillaries in the outer integuments, a disturbance of the heart's action, and a congestion of some of the internal organs, and particularly of the mucous membrane of the respiratory tract.

Taking it for granted that at a given moment there is a certain quantity of blood in the body which is distributed throughout the vascular system, a greater amount of blood than is normal will

accumulate in some portion of the system when a contraction of the capillaries in an area of the surface takes place. Such an accumulation causes an over-distention of the capillaries, and consequently a congestion of the part. As examples of this may be cited, the facts that deep-seated inflammations, or congestions, are relieved by counter-irritation of the skin, and it is by no means necessary to apply the counter-irritant directly over the organ affected to obtain the desired result; and also, that frequently inflammation, and even ulceration, of the bowels is a result of extensive burns and scalds of the skin of the chest or abdomen. In this latter case the capillaries of the skin are violently contracted and the blood driven to other parts of the body, and especially to the intestines, causing a congestion, followed by inflammation of their mucous membrane.

In connection with, and perhaps caused by, this contraction of the capillaries of the skin by cold there is always an irritation of the distal nerve ends, which, by reflex action, produces a change of the heart's action, which, in turn, becomes a factor in the production of the congestion in other portions of the body.

The blush of shame is produced by reflex nervous action, the cause of which, however, is central and not peripheral, and not unfrequently congestion of the lungs is produced by violent or long-continued emotional disturbances. The reason why the mucous membrane of the respiratory tract is more liable to be the seat of this congestion than any other portion of the body, must be looked for in the

fact that it, among civilized nations, is hardly ever free from irritation in one or the other portion of its extent. We constantly inhale particles of vegetable and mineral substances in the shape of dust, which, by engaging the cilia of the epithelium, act as irritants. This, together with the impure air surcharged with carbonic acid which we breathe in the confined atmosphere of our dwellings and public halls, produces a want of tone in the mucous membrane of the respiratory tract and its capillaries, thus predisposing it to congestion. For, as all fluids, so will the blood in the body when pressed upon at any particular point, seek an outlet at the point of least resistance—in this instance, the capillaries of the mucous membrane of the nose, pharynx, trachea, and lungs. Catching cold may then be defined as a momentary lowering of the temperature of the body by external influences, which causes both directly and indirectly an uneven distribution of the blood, and thereby a congestion or inflammation of internal organs.

Here the question may be raised: Why is it that some persons are more liable to catch cold than others, who, perhaps, are more exposed to cold and the inclemency of the weather?

In order to answer this question I must state that the power of producing heat in the system may be weakened by a number of causes, and that when thus weakened it is not able to produce an extra amount of heat when demand for it is made by exposure to a lower temperature. Thus we find that a person who leads a sedentary life and confines himself in an atmosphere artificially heated to from 75° to 80° Fahr., accustoms his system habitually to

produce little heat, because little demand is made for it; or one whose digestive apparatus is out of order will not properly digest his food, and cannot, therefore, produce sufficient heat by oxidation of the food; or one who is deprived, voluntarily or involuntarily, of the necessary amount of oxygen, be it by being confined in close rooms or on account of disease of the lungs; or finally one who does not take exercise, and so does not produce heat by muscular motion, will easily take cold from the slightest exposure. While on the other hand, a person who lives an out-of-door life, and thus exercises his heat-producing faculty, takes cold but rarely, even though much exposed.

To prevent taking cold, therefore, a person should take outdoor exercise at all seasons and in all kinds of weather, should not dress too warmly, should have plenty of fresh air in his house, and especially in his bedrooms, and should not heat the air in his rooms above 68° or 70° Fahr.

Pathology of the Mucous Membrane.

This subject, if entered into extensively, would carry us far beyond the limits of a hand-book such as this, and I will therefore confine myself to a few generalities, referring the reader to text-books on pathology, and to the chapters on the different diseases of the upper air-passages in this volume, for a more detailed account of the morbid changes met with in the mucous membrane of the throat, nose, and naso-pharynx.

The mucous membrane lining the throat and nasal cavities is exceedingly liable to diseases of

an inflammatory character, which exhibit the same phenomena that are noticed in other parts of the body. Such inflammations, accompanied by pain, redness, and swelling, are sometimes *traumatic*, as when caused by the introduction of foreign bodies, the swallowing of corrosive substances, and the inhalation of irritating vapors; or they are *idiopathic* inflammations. Diseases of the throat and nose may also be results or symptoms of a systemic affection, such as tuberculosis, syphilis, cancer, scarlatina, etc. Finally, they may be of a nervous character, such as the various stages of paralysis of the different parts, and the laryngeal symptoms of hysteria. Then, again, we find the products and consequences of chronic inflammation in the throat as we do in other parts of the body, such as glandular enlargement, catarrhal ulcerations, and neoplasms, in different shapes and locations.

In most diseases of the larynx, pharynx, and nose the secretions from the mucous membrane are altered in quantity and character. They are either increased or decreased in quantity, and either flood the parts or leave them unnaturally dry.

The natural secretion of the mucous membrane being a watery exudation, keeping the parts moist without being visible as a substance, may in disease become thick and slimy, running together in semitransparent drops, to be collected into larger accumulations and expectorated as mucus. This thickening of the secretions is believed to be due to the admixture of new and old epithelial cells which have undergone a retrograde metamorphosis instead of covering the mucous membrane. Thus the lining

of the larynx, pharynx, and nose becomes in places denuded of its epithelial covering; such places are called *abrasions*. They are seen to be of a darker color than the surrounding mucous membrane, and appear slightly depressed below the general surface. Such an abrasion will in time develop into an *ulcer* covered with pus, and presenting a whitish appearance, depressed in the centre and showing raised edges.

From this description it will be seen that a simple inflammation may develop shallow ulcers which are *catarrhal* in their character, and are *not* necessarily due exclusively to a specific disease of the general system, such as syphilis or tuberculosis, as is taught in most text-books.

Therapeutics.

All remedies employed for the cure of affections of the upper air-passages should act first by protecting the parts from the influence of the air, and, secondly, by stimulating the mucous membrane and its secreting glands to a healthy action. Among these remedies, nitrate of silver stands in the first place as a stimulant and protecting agent. In the latter capacity it acts first by coagulating the albumen contained in the secretions, and, secondly, by being partly converted into insoluble salts of silver, the chloride, albuminate, and mucinate, by combining with the chloride of sodium, the albumen, and the mucine of the secretion. In order to obtain the stimulating effect of this remedy, it is necessary to make the solution strong enough to have a surplus

of nitrate of silver, which is not immediately converted into a chloride, used in the formation of an albuminate, or mucinate of silver.

Almost all the astringents, such as sulphate of copper, sulphate of zinc, tannic acid, alum, and others, are used with advantage, both in solutions applied with the brush, sponge, or cotton applicator, or by means of the atomizer, and in the form of powder blown into the larynx by means of the insufflator. They all act more or less as stimulants to the mucous membrane. The vapors of ethereal oils, such as are contained in tar, cubebs, tolu, benzoic acid, carbolic acid, benzole, etc., inhaled from vapor-inhalers, are employed for the same purposes.

Alteratives acting upon the secretions of the mucous membrane, and in absorbing swellings, are given internally to aid the topical applications, and are also locally applied.

Modes of Administering Remedies.—Nitrate of silver in solution is applied to the ulcers, abrasions, or centres of inflammation, by means of a soft camel's-hair brush, mounted on a stiff bent wire, held in a mirror-handle, or by means of a small piece of sponge or tuft of cotton held in the sponge-holder or applicator. It should never be applied all over the mucous membrane, as is done by the old-fashioned probang. Solutions of not less than forty grains to the ounce should be employed, and frequently the strength can with advantage be increased to sixty, eighty, and even one hundred and twenty grains to the ounce of water, or water and glycerine. Glycerine alone should never be used as

a solvent for the silver salt, as its great affinity for water leaves the mucous membrane unpleasantly dry, and causes a severe burning pain in many persons.

As has already been stated, this drug is a powerful stimulant to the mucous membrane. But besides being this, it acts also as a local anæsthetic and an astringent, and should therefore be used with great discretion. It is beneficial when used in the first stages of an acute inflammation, as, for instance, in tonsillitis, where it allays the pain by its anæsthetic action, contracts the capillaries by its astringent action, and protects the surface of the mucous membrane by the formation of a film of albuminate, mucinate, and chloride of silver. Its stimulating action comes into play in the atrophic conditions of the mucous membrane and its glands. In the subacute and chronic inflammations attended with hypertrophic conditions of the glandular and submucous tissue, nitrate of silver is harmful.

Solutions of this salt under no circumstances act as an escharotic or caustic; that is, they do not devitalize the cells composing the tissue with which they come in contact, which statement can readily be substantiated by microscopical observations. The formation of the flakes of albuminate, mucinate, and chloride of silver, being mistaken for sloughs, has given rise to the misconception that solutions of nitrate of silver act as a caustic.

Nitrate of silver in the solid form is applicable only to deep specific ulcerations, and for the corrosion of neoplasms too small for operative interference, or for cauterizing the wound after extraction of a neoplasm, with a view to prevent its return. It is

best used by fusing a small piece to the roughened end of a bent silver probe mounted in a mirror-handle. After use, the lunar caustic coating should be remelted by holding the end of the probe over the lamp, so as to destroy all infectious material clinging to it.

Nitrate of silver is also often advantageously used as an inhalation from the atomizer, either the steam or hand apparatus. When so used, the solution should not be stronger than ten grains to the ounce of equal parts of glycerine and water.

Iodine dissolved in glycerine, locally applied, is an admirable remedy in the hypertrophic conditions of the upper pharynx and nasal cavities, acting as an alterative and promoting absorption of the hypertrophied tissue. It is, however, not applicable to the larynx, as it often produces violent spasms of the glottis.

Iodoform, acting like iodine as an alterative, has the advantage of being a local anæsthetic, but it also has the great disadvantage of its peculiar, penetrating and lasting odor, which is very difficult to disguise or prevent. I have, however, found that vaniline, in the proportion of ten grains to ℥j of iodoform, will to a very great extent, if not entirely, disguise the odor of the drug. It may be used in the form of a fine powder with the insufflator, and is especially applicable for dusting the ulcerations in syphilis and phthisis; or it may be dissolved in ether and used with the spray, the ether heightening the anæsthetic effect of the drug.

The other astringents enumerated may be applied in the form of powder, mixed with sugar of milk in

various proportions, by means of the insufflator. When so used, they should be rubbed down to an impalpable powder and kept dry. Large particles of the remedies, if introduced into the throat, act as foreign bodies, and produce more irritation than is desirable. Or they may be applied in solution by the brush, sponge, or atomizer.

Volatile substances are best used for inhalation from the vapor-inhalers.

The touching of ulcers or abrasions in the cavity of the larynx or posterior nares is rather a difficult operation. It requires considerable practice for its successful performance, and is to be done in the following way:

After the mirror has been introduced by one hand, the patient himself holding his tongue with his fingers, protected by a napkin, and the image of the larynx is in full view, the sponge or brush is introduced with the other hand into the mouth of the patient, until its point nearly touches the image of the ulcer or abrasion in the mirror. The hand is then elevated, thereby carrying the brush downward, but always keeping the image of the ulcer and that of the sponge or brush in a line until the desired spot is reached. After touching the ulcer once or twice lightly, the brush or sponge must be quickly withdrawn, without coming in contact with either the posterior wall of the pharynx or the epiglottis and tongue. If a slight spasm of choking follows, it is easily counteracted by the patient swallowing a draught of cold water.

These local remedies, in the form of powder, may often with advantage be combined with each other,

or substances may be added to them for the purpose of dilution, or to prevent their being washed away by the secretions, immediately after they have been applied. So, for instance, may iodoform be combined with morphia and gum acacia, with a view to lessen pain by the morphia, and to cause the powder to remain longer in contact with the surface by the gum acacia, which, forming a paste with the secretions, cannot easily be dislodged. Solutions used in the spray can also be combined, and the practitioner must use his judgment in selecting the proper combinations.

Ointments also are frequently of use, especially for application to erosions on the septum, the posterior walls of the pharynx, and in the vestibule of the nose. Among these, the most useful are the ung. hydrag. flav., with morphia, as made by Mr. Llewellyn, of Philadelphia, and largely used by oculists in the treatment of chronic conjunctival inflammations, and a mixture of oxide of zinc ointment with calomel (gr. x to ℥j).

As caustics for the removal of hypertrophic tissue or small neoplasms, and the touching of ulcers, chromic acid, acetic acid, lactic acid, and a solution of acid nitrate of mercury are used, but, above all, the galvanic cautery.

For a local anæsthetic, solutions of cocaine hydrochlorate in the strength of from 4 per cent. to 20 per cent., are employed either by instillation with a dropper into the anterior nasal chambers, or by saturating pledgets of cotton and placing them against the spot to be made insensible, or with the atomizer, or, finally, in the shape of lozenges, for

the purpose of overcoming the pain during deglutition in some of the laryngeal affections.

Local applications should never be made without having first thoroughly cleansed the mucous membrane. This is best done by an alkaline solution, thrown into the cavities by means of the spray. An excellent solution for this purpose is Dobell's solution, composed of

℞.—Sodæ bibor.	
Sodæ bicarb.	āā ʒj.
Acid. carbol.	gr. xxx.
Glycerinæ,	fl ℥j.
Aquæ font.	Oij.—M.

which is not only cleansing, but produces a pleasant sensation in the nasal and laryngeal cavities. Within the last two years I employ instead a solution composed of the following ingredients:

℞.—Sodii bicarb.	ʒ viij.
Sodii bibor.	ʒ viij.
Sodii benzoas,	
Sodii salicylas,	āā gr. xx.
Eucalyptol,	
Thymol,	āā gr. x.
Menthol,	gr. v.
Ol. gaultheria,	gtt. vj.
Glycerine,	℥ viijss.
Alcoholis,	℥ ij.
Aquæ,	q. s. 16 pints.

This formula gives a solution which is sufficiently alkaline to dissolve the thickened secretion adhering to the nasal mucous membrane, and as it is of the proper density, it is bland and unirritating, leaving a pleasant feeling in the nose. At the same time it

is antiseptic and acts as a deodorizer, being in this respect far superior to Dobell's solution, or any other non-irritating deodorizer and antiseptic. As it is, however, inconvenient for many patients to have so large a quantity of solution on hand, Mr. Frederick Brown, one of our Philadelphia druggists, made the solid ingredients into a compressed tablet, so that one, when dissolved in two ounces of water, will make a solution identical in its effects with the solution made after the above formula, and most patients prefer the tablets to the solution.

If the secretions have become inspissated, as is frequently the case in the nasal cavities, the crusts should first be softened with the alkaline solution, and then removed by a copious stream of salt and water from the anterior nasal douche, or, if still adherent, should be loosened by instrumental interference.

Remedies are also frequently used in the form of lozenges—that is, they are combined with a fruit paste, generally currant paste, which is pressed into small round or oval cakes. These lozenges are to be slowly dissolved in the mouth, thus impregnating the saliva with the medicine. By swallowing this saliva, it comes in contact with the posterior wall of the pharynx and also enters the larynx, acting upon the mucous membrane.

Among the alteratives which taken internally act more especially upon the mucous membrane of the larynx, pharynx, and upon the Schneiderian membrane, are iodide of potassium, bromide of potassium, calomel, cubebs in the form of the resin oil, or the cold fluid extract, crude petroleum, and other

substances which might be named. The iodide, bromide, and calomel should be given in small doses; and I have found that a combination of the former two is preferable, and can be borne much longer by the patient than either alone.

Acute as well as chronic inflammations of the larynx and naso-pharynx are greatly influenced by counter-irritation, such as is used in deep-seated inflammations in other parts of the body. Among them may be named external application of iodine, mustard, croton oil, and fly blisters. In some severe cases, especially of œdema of the glottis and epiglottis, leeches applied to the neck are recommended by high authorities, and are often of the greatest advantage in promptly relieving the tension of the parts, and consequent stenosis of the larynx.

Inhalations of ether, chloroform, nitrite of amyl, and other powerful sedatives are employed in nervous affections of the larynx. In chronic tonsillitis local applications of tr. iodinii, tr. ferri chlor., concentrated solution of tannic acid, and solid nitrate of silver are used, but with doubtful results. Lately the injection of iodine solution into the substance of the tonsil has been recommended, but my experience shows that very little if anything is gained in this way.

Many other remedial agencies are employed by a variety of methods in treating diseases of the throat; they will suggest themselves to the intelligent observer in special cases.

CHAPTER VII.

ACUTE LARYNGITIS.

The affections of the throat are divided into two distinct classes, which are distinguished by location and anatomical relation of the parts affected. Thus we must consider the diseases of the larynx proper under one head, while the affections of the pharynx, anterior nasal cavities, and the naso-pharynx are to be considered under another. The different members of these two classes, however, intermingle with each other very frequently, and it often becomes difficult to determine to which of the two divisions an affection belongs. But this difficulty is purely theoretical, and does not in the least affect the treatment or prognosis.

For instance, a chronic laryngitis is almost always associated with a chronic inflammation of the mucous membrane of the pharynx and naso-pharyngeal cavity, and only by careful examination into the history of the affection can we determine whether to call it a laryngitis or a pharyngitis. To elude this difficulty, some authors have adopted compound names, such as laryngo-pharyngitis, or pharyngo-laryngitis; but these appellations have not been generally accepted, and I shall therefore not use them in this volune.

By far the most common of all throat diseases which come under our notice is the acute laryngitis

so frequently occurring in childhood and early adult life. It consists in a more or less extended inflammation of the mucous membrane lining the larynx, attended by heat, pain, and swelling, and by general febrile symptoms, such as acceleration of the pulse, increase of bodily temperature, dryness of the skin, loss of appetite, etc.

Varieties.—Two varieties of this affection are recognized, which differ from each other more in the severity of the symptoms than in the causation. These are the ordinary mild acute laryngitis, and the grave acute laryngitis, sometimes called œdematous laryngitis, because œdema is a frequent complication.

Cause.—This affection may be of traumatic origin, or may be purely idiopathic.

If *traumatic*, it may be caused by the presence of a foreign body in the larynx, such as a fish-bone, pin, button, etc., swallowed, or rather inhaled accidentally, or by the swallowing of corrosive substances accidentally, or with suicidal intent,[1] or by the inhalation of acrid vapors or dust. If *idiopathic*, it is caused by a sudden chilling of the mucous membrane, or is dependent upon and a symptom of a general disorder of the system, such as scarlatina, measles, diphtheria, etc., or, finally, it may be caused by external injuries to the neck.

[1] Primary acute laryngitis is, however, but rarely the result of intentionally swallowing corrosive substances, because the suicide expects to be burned by the liquid, and swallows it quickly; while the person swallowing a corrosive substance accidentally is surprised or startled, and takes an inspiration, thus introducing some of the fluid into the larynx.

Symptoms.—In traumatic acute laryngitis, the symptoms show themselves immediately after the introduction of the irritating substance, and last for some time after the removal of the foreign body, if such be the cause, or, in the case of corrosive substances having been swallowed, until the destruction of tissue has been arrested, and the process of repair is completed.

In idiopathic acute laryngitis, on the other hand, the symptoms are not developed until some time after the exciting cause has made its impression.

The symptoms in both varieties of the disease are pain about the throat, a feeling of constriction, hoarseness sometimes amounting to aphonia, difficult and painful deglutition, dry and hard metallic cough. Respiration is, however, not usually affected. Later on the cough becomes loose and expectoration appears, which is at first of a yellowish-green color and very thick, becoming gradually more limpid and lighter in color. On laryngoscopic examination we find the mucous membrane of a uniform intense red, and somewhat swollen. The pillars and tonsils, as well as the uvula and soft palate, participate in the general hyperæmia.

The epiglottis is generally erect and thickened, and the ventricular bands are so swollen as sometimes to obscure the view of the vocal cords.

The vocal cords are reddened, but are generally of a lighter color than the mucous membrane in their vicinity, so that they can be distinguished from the ventricular bands. The arytenoid cartilages are red and swollen, and appear like balls.

In the graver and more rare form of acute laryn-

gitis these symptoms appear very rapidly, and the swelling of the mucous membrane becomes so great by œdematous infiltration, especially on the epiglottis, ventricular bands, or walls of the *sub-glottic* cavity, as to interfere with respiration, and give rise to very grave symptoms of asphyxia, which may result in death if not speedily removed.

Duration.—The duration of idiopathic acute laryngitis is usually a week or ten days from the first appearance of the symptoms to perfect restoration of health in the parts, but it may frequently be cut short by active treatment, or may extend over two weeks in debilitated subjects. The duration of traumatic acute laryngitis cannot be determined, as it depends upon the extent and severity of the injury received.

Treatment.—The ordinary slight form of acute laryngitis without the complication of œdema readily yields to the topical application of astringents by means of the atomizer. Of these, a ten-grain solution of alum, to which is added a drop of the dilute carbolic acid, is perhaps the most satisfactory in its results.

Hot vapor inhalations of tincture of benzoin or balsam of tolu afford relief by loosening the cough.

Internally, saline purgatives, and a combination of iron, chlorate of potassa, and bromide of potassium, should be given. This latter I am in the habit of prescribing in a form such as this:

℞.—Tr. ferri chlor. fl ʒ ij.
Potass. chlor. ʒ ij.
Potass. brom. ʒ iij.
Ext. glycyrrh. ʒ j.
Aquæ dest. q. s. fl ℥ vj.

Sig. A dessertspoonful in water every 3 or 4 hours. Gargle and swallow.

Or in the form of lozenges, which are more easily taken by children, and are fully as effective, if not more so than the liquid mixture. The following is the formula:

> ℞.—Potass. chlor.
> Potass. bromid.
> Pulv. ext. glycyrrhizæ, āā gr. iij.
> Tinct. ferri chlor. ♏ $1\frac{1}{2}$.
> Sugar, etc., q. s. to make one lozenge.

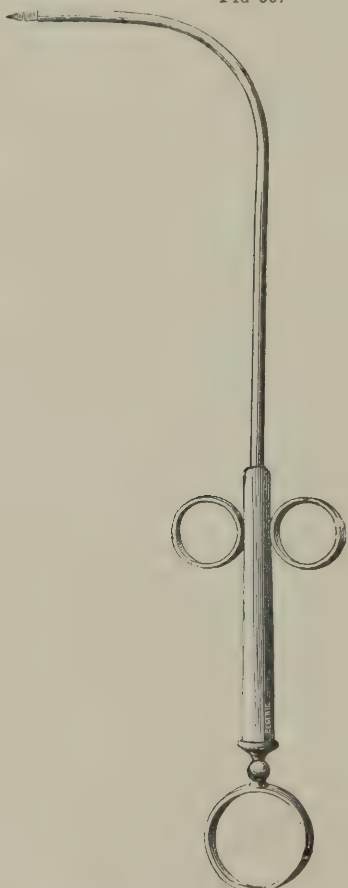
It has the effect of allaying the irritability of the mucous membrane, and especially of reducing the swelling of the palate and epiglottis, thus diminishing the dysphagia.

Counter-irritation, by means of iodine or mustard applied to the skin over the larynx, should always be resorted to, and very often alone leads to a speedy termination of the affection. The application of cold to the neck by means of an ice bag or a soft rubber tube wound loosely around the neck three or four times, through which ice water is caused to flow, aids materially in reducing the inflammation and gives great comfort to the patient. Cloths dipped in ice water are, however, not to be recommended, as they keep the skin wet, and must be renewed very frequently to do any good.

In the graver form, complicated by œdema of the larynx, or with consequent stenosis and embarrassment of respiration, there is, as a general rule, no time to wait for the slow action of saline purgatives, counter-irritation, leeches applied to the neck, or venesection, to prevent death from suffocation. A more speedy and efficient method of disgorging the parts of their blood and serous exudation has to be

resorted to. This consists in freely scarifying the mucous membrane by means of a small knife-blade

Fig 55.



Tobolt's concealed laryngeal lancet.

attached to a curved handle and guided by the laryngeal mirror (Fig. 55). A more detailed de-

scription of this instrument will be found further on.

By this means the alarming symptoms of suffocation are arrested, and time is gained for the action of astringents, counter-irritation, etc., to effect resolution. If, however, circumstances will not permit of this method being employed, tracheotomy, or intubation, should be at once resorted to, so as to insure perfect oxygenation of the blood. If left until everything else has failed, and the toxic effects of carbonic acid in the blood have progressed too far, a sudden and even complete oxygenation of the blood will not restore the normal condition, and the patient will succumb to the poison, and will be asphyxiated with his lungs full of fresh air.

Ulcers are rarely if ever formed in acute idiopathic laryngitis, while suppuration and the formation of abscesses are often met with. The latter are treated as if situated on the surface of the body. In opening them the knife, which should be a guarded one, is guided by the laryngeal mirror.

Should the inflammation be confined to the mucous membrane of limited parts of the larynx, the affection is designated as *epiglottidis* if the epiglottis is the seat of the inflammation, "*corditis vocalis*" if the vocal cords are affected, and so on.

Œdema of the Larynx.

As has already been mentioned, it happens sometimes that a serous effusion is thrown out into the submucous tissue of the larynx, thus causing a very great swelling of the parts affected. It may occur

independently of any disease of the larynx; or as a sequel or complication in systemic diseases, such as smallpox, typhoid fever, scarlet fever, phthisis, and syphilis, and rarely in chronic nephritis; or as a complication of laryngitis, acute or chronic pharyngitis, acute or chronic tonsillitis, malignant disease of the tongue, epiglottis, etc.

The effusion, which may be of a bloody, serous, or purulent nature, is usually found in the submucous tissue of the ary-epiglottic folds, at their inner surface, swelling them and the ventricular bands until they touch each other. Next in frequency it is observed in the epiglottis, then in the vocal cords themselves, and rarely in the mucous membrane lining the subglottic cavity.

The symptoms of swelling and stenosis generally appear very rapidly, and if the progress of the effusion is not promptly arrested by scarification of the parts, or the lungs not supplied with fresh air by an external opening in the trachea, or by the insertion of a tube into the laryngeal opening, according to O'Dwyer's method, a fatal issue of the disease speedily sets in.

Œdema of the larynx or parts of the larynx occurs most frequently in middle-aged persons, although it has been observed in newborn children and in extreme old age. Patients suffering from phthisis or syphilis are more frequently affected; one attack is often followed by another, so much so that Dr. Fauvel, of Paris, is in the habit of supplying patients who have had one attack of œdema of the larynx with tracheotomy instruments, so that in case of an emergency they may be at hand. In many cases,

however, the swelling does not completely close the opening of the larynx and trachea, even at the height of the affection, and consequently the dangerous symptoms are less marked. The patient generally complains of a feeling of oppression, pain, and fulness of the throat; and frequently a *barking* cough of a peculiar character is observed—probably due to the swollen parts acting like foreign bodies, and causing the irritation and excitation to cough. If the epiglottis or ary-epiglottic folds are the seat of the swelling, extreme dysphagia is often experienced by the patient.

On examination with the laryngoscope the mucous membrane is usually found to be hyperæmic, and of a uniform red, which is increased to scarlet or even purple over the swollen parts. These are always more or less pear-shaped, because the serous effusion gravitates toward the interior of the larynx, and bulges the mucous membrane more below than above. If œdema complicates other throat affections, the characteristics of these will be seen beside the œdematous swellings.

Treatment.—The treatment must be directed to the speedy absorption or evacuation of the serous effusion by scarification in severe cases, as has already been described under the head of acute laryngitis, and by counter-irritation, bleeding, and local astringent applications. Among the counter-irritants, mustard-plasters and fly-blisters act more promptly than iodine and croton oil when applied to the neck. Bleeding should be accomplished by leeches or cupping, and the general health should be taken into consideration in regard to the amount

of blood to be taken. The astringents should be in the form of finely nebulized solutions introduced into the larynx by means of the atomizer, and among them a strong solution (fifteen to twenty grains to the ounce) of alum acts in most cases with great promptness in reducing the swelling; but solutions of tannic acid, chlorate of potash, iron, and others may be used in the same manner with very good results. Nitrate of silver or other caustic applications should not be used, as the spasm following their introduction into the larynx, which under ordinary circumstances is very slight when only a small ulcer or abrasion is to be touched, becomes severe when a larger surface has to be brushed over. The blood already not being fully aërated because of the obstruction to respiration, if suddenly deprived of a fresh supply of oxygen, even for a few seconds only, becomes surcharged with carbonic acid. A reaction is prevented, and the patient is asphyxiated.

Subacute Laryngitis.

When an acute inflammation of the larynx is subsiding, or when the inflammatory action of the mucous membrane has been from the beginning but slight, we noticed what is termed a *subacute laryngitis*, which exhibits the following symptoms:

Symptoms.—The patient complains of little or no pain, slight dysphagia, little cough, more marked in the mornings, with a yellow tenacious expectoration, and slight hoarseness of the voice. On laryngoscopic examination the mucous membrane is seen to be redder than normal, with here and there spots of

a deeper red; the vessels appear injected, and can be traced for a considerable distance, especially on the free margin and glossal surface of the epiglottis. The pharynx and velum palati are almost always implicated in the general hyperæmia.

Treatment.—This stage of inflammation usually disappears in a few days under the treatment which has been adopted for the acute form, and recovery is frequently hastened very much by topical applications, by means of the brush, of solutions of sulphate of copper, sulphate of zinc, and especially nitrate of silver, to the brighter spots.

Diet.—In all cases of acute and subacute inflammations of the larynx, and especially when dysphagia is present, soft food, such as gruels, mush, milk, and beef-tea, and cold drinks should be given. With children, iced milk sweetened with a little sugar is often the only food which can be taken. When the difficulty of swallowing is very great, liquids can often be taken more easily through a glass tube or straw, and soft food can be swallowed by the patient bending the upper part of the body and the head forward.

CHAPTER VIII.

CHRONIC LARYNGITIS.

Simple Chronic Laryngitis.

In some cases, especially when the system is below par, and when the acute stage, being very mild, has not been treated, the acute and subacute laryngitis

will pass into the chronic stage of inflammation. In phthisis, tuberculosis, cancerous disease, and during the convalescence from continued fevers, when the system is so low as not to react by an acute inflammation, we observe a subacute and then chronic form of the disease. As chronic laryngitis is due to a variety of causes, and as there are slight differences in the symptoms and laryngoscopic appearances of the disease excited by these causes, several forms of chronic laryngitis must be recognized, and these will be treated of under different heads.

Symptoms.—The symptoms of simple chronic laryngitis resemble those of the subacute form of inflammation in many points. The patient complains of a sense of constriction of the throat, but of no difficulty of deglutition, a feeling of dryness of the mucous membrane, and a dry and hacking cough, with white stringy expectoration resembling boiled starch. The voice is usually hoarse, faltering, and easily fatigued, while there exists no embarrassment to respiration. On laryngoscopic examination, we find the mucous membrane to be in a state of hyperæmia with spots of heightened color, the vessels injected, the glands enlarged, and abrasions frequently in the inter-arytenoid space.

This form following acute laryngitis, and caused by a want of tone in the system, is looked upon by some writers as very rare. Its peculiarity consists in the fact that true ulcerations are very rarely found, but that abrasions are frequent.

Another very frequent cause of simple chronic laryngitis is the so-called mouth-breathing, produced

by nasal obstruction; for it is a well-established fact, that the air as it passes through the tortuous nasal chambers is raised two degrees in temperature, is filtered of its dust, and is saturated with moisture by the secretion of the serous glands, embedded in the nasal mucous membrane. If now, the nasal passages are obstructed, no matter from what cause, this dry, cold, and dust-laden air directly impinges upon the mucous membrane of the larynx, and, continually irritating it, causes a chronic inflammation. And, finally, abuse or the faulty use of the voice both in speaking and singing is a frequent cause of simple chronic laryngitis in speakers and singers.

Treatment.—The treatment to be adopted in this form of chronic laryngitis should be, first of all, the removal of the cause by removal of the nasal obstructions, rest of the voice, and then by local treatment directed to the laryngeal mucous membrane as well as general tonic treatment. The local treatment consists of stimulation of the mucous membrane by vapor inhalations of tolu, or of tincture of benzoin, or by astringents in solution introduced by means of the atomizer. The most important feature, however, is the topical application of a forty to sixty grain solution of nitrate of silver to the abrasions. These applications should be made to the sores only after the secretion has been washed off by an alkaline antiseptic solution thrown into the larynx with an atomizer, by means of a piece of sponge held in the sponge-holder, or better with the brush, and should be repeated every other day if possible, so as to keep the raw surfaces covered, and allow the new cells to form under the artificial scab.

The application should not be made with the cotton-applicator, as there is danger of a small thread becoming detached and giving rise to irritation and consequent often distressing cough. After the abrasions have healed the silver solution should be discontinued, and in its stead an astringent powder should be thrown into the larynx with the insufflator. For this purpose, sulphate of zinc and sugar of milk in equal parts, with the addition of a little gum arabic powder, will be found the most serviceable application. The powder should, however, be very fine, and care should be taken not to blow any lumps into the larynx.

In this form of laryngeal disease, lozenges are frequently the best form in which to exhibit such remedies as are intended to act both locally and by absorption, for it has been proved beyond a doubt, that a portion of the saliva, as well as the secretion from the mucous membrane of the pharynx, finds its way into the larynx, and especially comes in contact with the mucous membrane covering the inter-arytenoid space. Therefore, if we impregnate the saliva with some mild astringent substance, we will obtain a direct local action upon the laryngeal mucous membrane, which, being long continued by the slowly dissolving lozenge, is very beneficial.

The persistent and often spasmodic cough being the most distressing symptom, we must direct our attention to its alleviation. This laryngeal cough is always due to irritation of the laryngeal mucous membrane, and especially of the mucous membrane lining the inter-arytenoid space, and not to congestion of the bronchial or tracheal mucous membrane.

Expectorants and cough mixtures will, therefore, not be as serviceable as topical applications. The laryngeal irritation, however, often produces what might be termed a reflex irritation, lower down in the respiratory tract, and, if such be the case, anodyne expectorants will be found of great service. Under no circumstances, however, should syrups be used, as they invariably derange the digestive system, and thereby interfere with proper nutrition of the system at large. The following formula I found very serviceable in allaying this most distressing symptom of chronic laryngitis:

℞.—Potass. bromide,	℥ss.
Potass. cyanide,	gr. iij.
Ext. prun. virg.	fl ℥ss.
Ext. grindelia robusta,	fl ʒiij.
Mucil. acaciæ,	
Aquæ dest.	āā q. s. fl ℥iv.—M. Ft. S.

Sig. Teaspoonful in water 4 times a day.

Tonics, and especially iron, are of great service in building up the system, thus aiding in the restoration of health to the mucous membrane of the larynx. A faradic current of electricity applied externally, the poles being placed one on either side of the neck, acts as a local tonic, and is of great benefit.

Mild alcoholic stimulants are also indicated in many cases, and particularly the heavier still wines, such as Burgundy, Sherry, and, above all, the Hungarian wines—Buday and Tokay. These latter wines, when pure, possess intoxicating qualities in but a slight degree, in spite of the fact that they contain a considerable amount of alcohol; and it has

been the experience of the author that a moderate quantity of them taken as a tonic does not affect the head. Mr. Lorenz Reich, of New York, imports these wines for medicinal use only, and it is owing to him that this admirable tonic is obtainable in this country in its original purity. The Tokay should be given in doses of a sherryglassful three or four times a day, and Buday is best taken at meal times, a wineglassful at a time.

As a summer resort for such cases, the sea-shore should be avoided, as the dampness of the atmosphere is very apt to increase the swelling of the mucous membrane; in fact, we can observe always an increase in the symptoms during easterly winds, even when the patient remains in the house. Plenty of fresh air, and especially mountain air, on the other hand, is of the greatest benefit, and will, together with good nourishing food, often alone be sufficient to remove all trouble in the throat.

Another very frequent form of chronic laryngitis is the so-called clergyman's sore throat, or the laryngitis of singers and speakers. In its symptoms it is identical with the ordinary simple chronic laryngitis, but its causation is widely different.

Cause.—Its cause lies in a faulty use of the voice, or in abuse of it; but in order to comprehend how such a factor can produce such results we must look into the mechanism of the production of the voice.[1]

We found that the voice is divided into what are called registers, which divisions are produced by alterations in the vocal cords themselves, so as to

[1] See "Voice in Singing," by E. Seiler; J. B. Lippincott & Co., 1875.

relieve the pressure brought to bear upon them, both by the muscular contraction stretching them, and by the force of the current of air from the lungs. If we examine a larynx in the act of phonation, and ask the patient to raise the pitch of his voice until one of the limits of the register is reached, we will see a slight redness or congestion of the cords if the same position and tension of the cords are persisted in, and if the same amount of vibrating surface is exposed to the air-current. This congestion of the cords becomes more and more extended the higher the patient sings with the same register mechanism. The cords are thereby much more tightly stretched, and by the influx of blood are made heavier, requiring a greater amount of air force to set them into vibrations. As soon, however, as the unnatural and excessive tension is removed, the congestion disappears, and the cords resume their pearl-white color. If this transgression of the natural limits of the registers is frequently repeated, the congestion of the cords does not disappear, but becomes chronic, and spreads to the neighboring mucous membrane, while the undue force of the air-current, striking the parts above when in their peculiar positions for articulation, produces an irritation and congestion of the pharyngeal mucous membrane.

Men speak in the two chest-registers, constantly using either, the upper or lower according to the requirements of proper intonation. Women speak in the falsetto, but laugh and scream in the head register. Public speakers, in order to make themselves heard in a large hall, often strain their voices, that is, they force an extra amount of air through

the rima glottidis, and in doing so contract the large muscles of the neck—the sterno-cleido-mastoid, the sterno-thyroid, and thyro-hyoid.

The contraction of these muscles fixes the larynx, and prevents its participation in the vibration of the column of air above and below it, and also interferes with the free action of the muscles of the larynx proper. This gives rise to an extra expenditure of muscular force, and a constant feeling of fatigue after a few minutes of speaking or reading aloud.

The unnatural intonation used by public speakers, and especially by preachers, which consists in drawing the vocal tone of the vowels over a considerable part of the scale, thereby transgressing the natural limits of the registers, adds not only to the expenditure of muscular force, and is a consequent source of fatigue, but also increases the already existing congestion of the cords and neighboring mucous membrane. If then, after such abuse of the vocal organs for a time, the preacher or public speaker exposes himself to sudden changes of temperature, the congestion is very apt to turn into inflammation, which speedily becomes chronic, and the patient attributes his affection to this exposure after use of the voice.

Treatment.—The treatment as regards remedial agents is the same as in ordinary chronic laryngitis and pharyngitis, and will effect a cure of the disorder provided the patient does not use his voice more than absolutely necessary for ordinary conversation. As soon, however, as he resumes his work as preacher or lecturer, the symptoms return speedily, and in a short time his throat feels as sore as ever.

We must, therefore, in treating such cases, add another factor to our treatment, viz., training and cultivation of the voice in speaking.

In order to do this, the patient must first be taught to sing up and down the scale, so as to learn to recognize the limits of the natural registers, and learn not to transgress them in singing or in speaking. He then must be taught to pronounce the sounds of articulate speech with the proper position of the organs, the larynx, soft palate, lips, and tongue, using as little breath as possible. He must further be instructed not to change the pitch of his voice on any one syllable, but in order to produce a rise and fall in the voice, to make the change on different syllables—that is, not to draw the vocal tone over.

It will be found that the patient, when he has acquired the natural way of speaking, can fill a larger hall or church with less exertion, and can speak for any length of time without feeling fatigued, except from his mental effort and from standing for an hour or so. A more definite description of this portion of the treatment cannot be given, because every case requires a careful study of its own peculiarities, which suggest different expedients to attain the desired result, to be chosen with regard to the mental capacity of the patient, and to be under the direction of an intimate knowledge of the mechanism, both of the production of the voice alone and of articulation.[1]

[1] See "Voice in Speaking," by E. Seiler. J. B. Lippincott & Co., 1875.

The practice should be repeated as often as possible, and should not be extended over a period of more than fifteen minutes at one time in order not to fatigue the patient.

Laryngitis Phthisica.

Another form of chronic laryngitis is found in phthisis and tuberculosis, and as it presents some peculiarities it may be considered under a separate head.

Symptoms.—In laryngitis phthisica or tubercular laryngitis we find that the respiration is always more or less hurried, and becomes embarrassed in the later stages. The patient complains principally of a dry, hacking, and painful cough, which later becomes looser and more frequent, accompanied with copious expectoration of greenish or yellowish phlegm. Swallowing is difficult in the earlier stages, and subsequently becomes painful. Whenever there is extensive ulceration of the epiglottis or ary-epiglottic folds, the pain in deglutition is felt as a sharp, lancinating pain in the ear on that side most affected in the larynx. The pain is considered by some authors as pathognomonic of cancerous disease of the larynx, but I have found it to be very common in cases of tubercular or syphilitic ulcerations, and it is a source of great suffering to the patient. The voice is always more or less hoarse and of a peculiar character, and aphonia usually sets in later. On laryngoscopic examination we find the mucous membrane in a state of hyperæmia, which culminates in certain places to form shallow ulcers,

especially in the inter-arytenoid space. Frequently we see also papillomatous excrescences in the inter-arytenoid space which give rise to a great deal of irritation and cough. The color of the mucous membrane of the larynx as well as of the pharynx and the velum with its pillars is of a peculiar ashy-red, very difficult to describe, but never to be forgotten when once seen (Plate II., Fig. 1). The epiglottis is usually thickened, and often presents abrasions or shallow ulcers on its free margin. The ventricular bands and the vocal cords are more or less swollen and reddened, causing the peculiar character of the voice which we notice in patients suffering from phthisis (Plate I., Fig. 1).

The most characteristic peculiarity of laryngitis phthisica is an abnormal pyriform swelling of the arytenoid cartilages; this is frequently seen in the laryngeal mirror before a physical examination reveals lung implication. The arytenoid cartilages appear very large and rounded at their inner surfaces, tapering gradually toward the side of the larynx until they are lost in the ary-epiglottic fold, their apices entirely disappearing. Often only one of the cartilages is thus tumefied, and it is then generally found that the lung on the same side is affected, while the other lung is still healthy. Occasionally we find cases in which the reverse is true. Less frequently we find a *turban*-like swelling of the crest of the epiglottis, which at the same time assumes a horseshoe bend. These two conditions have been observed to stand in a certain relation to the disease of the lungs, so that in the cases where we observe the pyriform swelling of the arytenoid

cartilages, the lung tissue has not as yet begun to break down, but as soon as the breaking down takes place in the lung the epiglottis begins to be affected. In the literature of the subject I find that but few authors make mention of these facts, while others either do not refer to them at all or merely hint at them by speaking of the phthisical œdema of the larynx.

In the laryngeal mirror these swellings do not give to the observer the impression of simple œdematous tumefaction, and free scarification of the parts does not relieve the symptoms—aphonia and dysphagia—caused by them.

Microscopical examination of a number of larynxes showing these swellings reveals the fact that the loose submucous tissue is largely infiltrated by a small-celled infiltration, with a tendency to the formation of depôts with cheesy centres, and, what is rather remarkable, hypertrophy of the glands and follicles, so as to amount almost to an adenomatous growth. There is also a certain amount of serous infiltration into the network of the submucous tissue, which only tends to increase the swelling.

In the advanced stages of tuberculosis we find tubercular deposits in the mucous membrane of the larynx, appearing as numerous small round elevations similar to the enlarged follicles which we observe in follicular pharyngitis. (Plate I., Fig. 2.) The swelling and ulceration of the epiglottis and inter-arytenoid space cause painful deglutition, and, the irritation being transmitted to the salivary glands, an increased flow of saliva is observed. The ulceration in the inter-arytenoid space, as well as

on the vocal cords themselves, often causes painful phonation, and the patient frequently complains of the air inhaled feeling hot, which sensation is due to the irritating action of the air on the raw surfaces.

Treatment.—The treatment of this throat affection consists, besides the administration of tonics, cod-liver oil, and alcoholic stimulants, mainly in reducing the irritability of the larynx by painting the ulcerated surfaces with strong solutions of nitrate of silver (60 to 120 grains to the ounce), covering them with iodoform and tannin with the insufflator, or with a powder compounded as follows:

℞.—Bismuth subnit.	ʒij.
Gum acaciæ,	ʒij.
Iodoformis,	ʒss.
Morphia sulph.	gr. xx.
Acid. tan.	gr. xxx.
Vaniline,	gr. xv.—M. Ft. Pulv.

spraying the larynx with a saturated solution of iodoform in ether, etc., and in stimulating vapor-inhalations. Lately lactic acid solutions have been recommended for the topical treatment of phthisical ulcerations of the larynx, but my experience has shown that they cannot be relied on, and give the patient so much pain as to be objectionable on that account. The bromide salts, and especially the bromide of sodium and ammonium in five- or ten-grain doses given internally, have a very good effect in loosening the cough and in reducing the tenacity of the expectoration. In the later stages, when deglutition becomes so painful as to interfere with the proper nourishment of the system, a spray of a 10 per cent. solution of cocaine thrown into the larynx a few

minutes before eating, or a lozenge of gelatine containing one-half grain of cocaine dissolved in the mouth, will in many cases enable the patient to eat an adequate amount of food, which otherwise would be impossible. Moderate daily exercise in the open air is, of course, essential in staying the progress of the disease of the larynx as well as of the lungs. Inasmuch as the laryngeal symptoms are dependent upon the lung affection, the prognosis is, of course, very unfavorable, but by proper treatment the patient can be made very comfortable as regards the laryngeal implication.

Syphilitic Laryngitis.

Secondary and tertiary syphilis show themselves very frequently in the mucous membrane of the larynx, pharynx, and mouth, and are one of the most common causes of chronic laryngitis.

Symptoms.—The afflicted patient usually complains of a slight hacking cough, hoarseness, and sometimes of difficult and painful deglutition. On laryngoscopic examination, the mucous membrane is found to be hyperæmic and swollen, with patches of a brick-red color, symmetrical in shape and distribution on both sides of the larynx. (Plate I., Fig. 3.) Two kinds of ulcerations are noticed in syphilitic laryngitis, the shallow and the deep. The shallow ulcer, which usually appears very suddenly, is surrounded by an areola of deep-red color, has slightly raised edges, and is colored by a yellowish creamy pus, which, however, is not very tenacious, and is easily washed away by a spray, exposing a

raw but seldom bleeding surface. It may be of almost any shape, but is most commonly oval in outline. The deep ulcer, on the other hand, appears slowly and gradually, and is not surrounded by a distinct areola. Its edges are raised and often ragged, and its surface is covered by a thick, tenacious pus, which cannot be easily washed away. It is usually of a rounded outline, and contiguous sores have a tendency to run together so as to form large ulcers of an irregular outline. The deep ulcer has also a tendency to invade the deeper-seated structures, thereby producing the great loss of tissue we so frequently meet with in syphilitic disease of the upper air-passages. When the epiglottis is the seat of the deep ulcer its edge usually appears ragged, with points projecting from the surface. This peculiarity may be explained by the fact that the glands which perforate the cartilage are destroyed by the ulcerative process before the cartilage itself is attacked, thus leaving the partitions to stand out above the surface of the ulcer. The shallow ulcers are the result of mucous patches, while the deep ulcers result from the breaking down of gummata in the mucous membrane.

The one great peculiarity of syphilitic ulcerations in the upper air-passages, and especially in the larynx, is their symmetrical distribution. Thus we find ulcerations of similar shape in the same position on either side of the larynx, occupying, for instance, the middle of each ventricular band, or, if we see an ulcer on one side only, we notice a focus of inflammation of similar shape in a like position on the other side, and what is true in regard to the sym-

metry of ulceration is also true of the distribution of foci of inflammation. Syphilomata are rarely seen in the larynx, while neoplasms of both benign and malignant nature are frequently met with in patients afflicted with syphilitic laryngitis.

The pharynx and soft palate always participate more or less in the general specific inflammation, and form a diagnostic sign warning the laryngoscopist *not* to use the instruments generally employed, but to use a mirror marked in some way as reserved for specific cases. This caution is of the greatest importance in private practice, as well as in dispensary or hospital work, for practical experience has proved that the disease in certain stages is readily communicated from one patient to another by infectious material clinging to the instruments, even after supposed thorough cleansing.

Signs of specific disease, which hardly ever fail, are two brick-red, narrow bands of inflammation running along the edge of the velum palati and stopping short equidistant from the root of the uvula, and a symmetrical distribution, in size, shape, and position, of brick-red patches of inflammation in the oral cavity (Plate II., Fig. 4).

Treatment.—The treatment of syphilitic laryngitis must consist in constitutional treatment with iodides and mercury, tonics, cod-liver oil, fresh air, etc., as is laid down in the text-books for any case of syphilis, and of appropriate local treatment. Some authors contend that the constitutional treatment alone is sufficient to arrest the progress of the ulceration and cure the inflammation, and that local applications are not only unnecessary but often give rise to great

inconvenience to the patient. My experience has been, however, that local applications not only hasten the cure and add to the comfort of the sufferer, but also in a great measure prevent the extensive destruction of tissue, and the subsequent, often disastrous, cicatricial contraction and deformity. I therefore look upon topical treatment as essential in these cases.

The shallow ulcers, the result of mucous patches, should be touched with solid nitrate of silver melted on the end of a silver probe, as described in Chapter IV., and, as a rule, will readily disappear under this treatment. Before touching them the pus should be removed from their surface with a spray, and, if necessary, with a sponge or brush moistened with an alkaline solution containing carbolic acid or other antiseptics, so as to expose a clean surface to the action of the caustic. It is well, especially for the beginner who is not sufficiently dexterous to prevent the silver from coming in contact with the non-ulcerated mucous membrane, to follow the application with a spray of a strong solution of salt, in order to convert the surplus of the nitrate into the inert chloride of silver.

The nitrate of silver is, however, not sufficient when we have to deal with deep ulcerations, and stronger caustics must be used to check their progress. Among the extended list of caustics, the most satisfactory in my experience are the galvano-cautery and a solution of the acid nitrate of mercury (one part to five of water), applied to the cleansed ulcerated surface. The galvano-cautery is to be used as a first application, making an eschar over the whole

surface of the ulcer, and when this has been thrown off, the acid nitrate of mercury solution is to be applied with a sponge. After a time, when the process of repair is beginning to set in, this application becomes painful, and should then be omitted, and the ulcerated surface should be dusted over with a powder composed of iodoform gr. xxx, tannin gr. x, and pulv. amyli gr. xx. Under such treatment I have seen extensive syphilitic ulcerations heal with little or no cicatricial contraction resulting.

Nitric acid, hydrochloric acid, chromic acid, and other caustics have all been recommended as applications to syphilitic ulcerations in the throat, but their action not being under perfect control, they cannot with safety be used; besides, they invariably give a great deal of pain to the patient.

It sometimes occurs that the perichondrium becoming affected, is detached from the cartilage, thus causing necrosis. If this occurs in the arytenoid cartilages, they may become detached, and, by falling into the trachea, may give rise to dangerous irritation of the trachea. They should, therefore, be carefully watched, and removed with the laryngeal forceps before there is any chance of their becoming detached spontaneously.

Besides the topical applications of caustics, the inhalation of carbolic acid solution from the atomizer, and the spraying of the larynx with some anodyne solution, when the pain is very great, are to be recommended.

The prognosis regarding the affection of the throat is rather favorable if the destruction of tissue has not gone too far; and patients in whom one of the vocal cords has been destroyed have been known to

regain the voice. In such cases the ventricular band of the same side takes upon itself the action of the lost vocal cord, and meets the cord on the opposite side to form the rima glottidis and produce a vocal sound.

There are also cases on record in which the greater part of the epiglottis has been eaten away by specific ulceration, and in which, after the ulcerated edge had healed, no difficulty of any account was experienced by the patient in deglutition.

Deep ulcerations of the larynx are also seen in the rarer diseases of lupus, elephantiasis, carcinoma, and perichondritis, and it is often very difficult to make a differential diagnosis, especially in lupus, between these affections and syphilis. Lupus but rarely occurs in the larynx primarily, and, if so, is soon followed by manifestations of the disease elsewhere. The ulcerations are not symmetrical, and the color of the mucous membrane is not of the brick-red hue seen in syphilis. The treatment is the same as recommended for lupoid ulcerations elsewhere. Elephantiasis of the larynx is so extremely rare in this country at least, that but very few cases have been recorded. The only case I have seen is a specimen in the possession of my friend Dr. Beecher, of Philadelphia, who kindly loaned it to me for examination. This disease never shows itself primarily in the larynx, and is only seen as a secondary manifestation when other parts of the body have been affected.

Carcinomatous ulceration due to the breaking down of cancerous infiltration of the tissues of the larynx, may readily be diagnosed by the aid of the

microscope. Perichondritis, as a rule, is secondary to ulceration or inflammation due to any of the above diseases, and but rarely occurs idiopathically.

Traumatic Chronic Laryngitis.

The inhalation of acrid vapors or dust incidental to many occupations, as well as the accidental introduction into the larynx of foreign bodies which remain there for some time, will produce a chronic laryngitis, which, on account of the causes being purely external, may be termed traumatic chronic laryngitis.

Symptoms.—When acrid vapors or dust are the exciting cause, the patient complains of a burning sensation, together with great dryness and fulness of the larynx, which cause him to clear his throat continually. A slight hacking cough is usually present. The expectoration, which is very scanty, and resembles cooked starch in consistence, is either grayish-white or stained with dust, and is apt to fly out of the mouth with considerable force in the shape of small pellicles when the throat is cleared. Where foreign bodies embedded in the tissue of the larynx cause the affection, the sensation is that of a localized pain increased in the act of swallowing, together with a feeling of dryness and fulness of the throat.

On laryngoscopic examination we find the appearances noticeable in simple chronic laryngitis.

Treatment.—The treatment must, of course, be directed toward removing the cause of the trouble by extracting the foreign body if one be present,

or by advising the patient to change his occupation, or, if that be not possible, by telling him to breathe through a moist sponge or respirator while working in an atmosphere filled with dust. If the vapors of acids be the cause, the sponge should be frequently moistened with lime-water or a strong solution of sodium carbonate.

As in the other forms of chronic laryngitis, exercise in the fresh air, good nourishing food, and topical application of nitrate of silver or astringents to the abrasions, as well as stimulating inhalations, should be employed to counteract the effects of the irritating causes of the affection, and to restore the mucous membrane to its normal condition.

As a preventive against acute as well as chronic laryngitis, the patient should be advised to bathe the throat morning and evening with *cold* water or cold salt and water, and not to wrap shawls and furs around the neck when going out into the open air. Nothing more predisposes persons to throat affections than this habit of keeping the neck warm. It interferes with the exhalation of the skin, and makes it tender.

Stenosis of the Larynx.

Stenosis of the larynx, or obstruction to the free ingress and egress of air through the larynx, is either temporary or permanent; that is, it may either be relieved by the curative power of nature, aided by internal or topical medication, or requires surgical interference for its cure.

Temporary stenosis is caused by swellings in the larynx of an inflammatory character, such as ab-

scesses, or by serous, mucoid, or bloody effusion in the submucous cellular tissue, such as œdema, which has already been considered. Permanent stenosis is produced by foreign bodies lodged in the larynx, by neoplasms, and by cicatricial contraction and adhesions following ulceration.

The treatment must consist in the removal of the foreign bodies or neoplasms, as described further on, while the cicatricial adhesions must be severed, if possible, with the galvano-cautery knife. It frequently happens that the vocal cords become agglutinated by the healing of linear ulcers, or after thyrotomy, thus producing stenosis of the glottis. They must then be cut apart, and kept so by constant motion during the healing process. If this is not possible, or if the stenosis exists in the subglottic cavity, dilatation with steel bougies must be resorted to. In all cases of stenosis, if the cause cannot be removed at once, tracheotomy should be performed as soon as possible to prevent carbonic acid poisoning of the blood.

CHAPTER IX.

FUNCTIONAL DISORDERS OF THE LARYNX.

Having described the symptoms and treatment of inflammation of the mucous membrane lining the laryngeal cavity, we can now proceed to consider the functional disorders of the larynx either as the

result of inflammatory processes or those independent of such causes.

Aphonia.

The most common of these functional affections is aphonia or loss of voice. It is due in the first place to an inability of the vocal cords to vibrate with sufficient rapidity to produce sonorous vibrations of the air, or to an inability of the vocal cords to vibrate in harmony with each other, thus producing an irregular motion of the air. In the first instance total loss of voice will be the result, in the latter hoarseness of the voice to a greater or less degree will be observed.

Causes.—This inability of the vocal cords to vibrate may be due to several causes:

1. To thickening or swelling of the cords in acute and chronic inflammations, and in œdema of the glottis, making them so heavy and inelastic that the current of air from the lungs cannot move them.

2. To the destruction of part or the whole of one or both vocal cords by corrosive agents accidentally introduced, or by extensive ulceration, the result of syphilis, cancer, or other ulcerative process.

3. To cicatrization of the cords following the operation for the removal of neoplasms, or the unsuccessful attempt at cutting the throat, or following the healing of linear ulcers, thus gluing the cords together.

4. To paralysis of the muscles of vocalization, either on one side only or on both sides, thus preventing the narrowing of the glottis to a slit, or causing a relaxation of the cords when approxi-

mated, so that the vibrations are too slow to be appreciated by the ear as a continuous sound.

5. To the presence of a neoplasm or foreign body which mechanically interferes with the sonorous vibrations of the cords.

Hoarseness or partial aphonia, being due to the same causes exerting their influence in a less degree, may be considered together with total loss of voice.

The aphonia which is caused by swelling of the cords due to inflammatory infiltration, hyperplasia, and œdema, the cords becoming so thick and heavy that they cannot vibrate with sufficient rapidity to produce an audible sound, together with its treatment and duration, has already been considered under the head of acute and chronic laryngitis. In the same way has destruction of one or both cords been mentioned under the head of syphilitic laryngitis.

The third cause of aphonia, the cicatrization following operations, wounds, or ulcers, and gluing the edges of the cords together, has been hinted at under the head of stenosis, but is of sufficient importance to deserve a more detailed description.

Aphonia due to Cicatricial Adhesion.

In case of linear ulcers lying along the free edge of the vocal cords, especially toward the anterior part, cicatricial tissue is formed by the healing of the sores, which is very apt to connect the edges of the cords at their insertion into the thyroid cartilage. This cicatrization, moving from before backward with the healing of the ulcers, produces a

gluing together of the cords in the same direction. By the contraction of the newly formed tissue the edges are drawn together until the end of the ulcer is reached, thus virtually shortening the vocal cords and glottis until only a small triangular hole is left, through which the air rushes inward and outward with a whizzing, and often whistling noise.

Vocalization being painful and the voice usually hoarse in cases of long linear ulcers of the cords, the patient desists from the use of the voice, and is advised to do so by the medical practitioner who has not made a laryngoscopic examination. But this want of movement of the vocal cords favors the formation of the cicatricial tissue, and when once a connection between the edges of the cords is established, it rapidly travels backward, making vibration impossible, and causing dyspnœa by closing the glottis.

The same union of the cords takes place after an unsuccessful suicidal attempt to cut the throat, in which an incision in a transverse direction is made in the angle of the thyroid cartilage at a point where the vocal cords are inserted, and cuts them longitudinally or, more frequently, obliquely. The large vessels of the neck not having been severed, the wound heals rapidly, and in doing so connects the edges of the cut cords by cicatricial tissue.

It is curious to note what a small opening of the glottis will admit sufficient air for the wants of the system, provided it grows smaller gradually. The quantity of air taken in through such a greatly contracted glottis would be altogether insufficient and death by asphyxia would result if the glottis were reduced to such a size suddenly.

Treatment.—The treatment in such cases consists in cutting through the cicatricial tissue connecting the edges of the cords with the laryngeal lancet, or the galvano-cautery knife. After the division the edges should be cauterized with solid nitrate of silver, and the patient required to use his voice by talking or reading aloud, even though the voice should be hoarse and vocalization painful, in order to prevent a reformation of cicatricial tissue and a reunion of the free edges of the cords.

In making the section of the cicatrix the epiglottis must be held back by the forceps described above, so as to obtain a good view of the anterior angle of the glottis.

If the opening of the glottis is so small that the system suffers from want of oxygen, and the throat of the patient is irritable and must be educated to bear the introduction of the instruments, so that immediate relief of the dyspnœa cannot be obtained by division of the cicatrix, tracheotomy or, better, laryngotomy should be resorted to without hesitation or delay. If the latter operation is decided upon, it is often possible to separate the cords by section from below, introducing the knife through the external wound, and cauterizing the cut edges in the same way, so that the laryngotomy wound can be closed immediately, when the introduction of a tube becomes unnecessary. This, of course, to a very great extent increases the chances of a speedy recovery from the operation. If, however, the division cannot be made from below, the tracheotomy tube must be introduced and the wound allowed to heal around it before any attempts at laryngoscopic

examination or operative interference from above should be made.

After the division has been made and the edges of the cords have healed, the voice frequently remains hoarse on account of the increased weight and thickness of the vocal cords by reason of inflammatory infiltration and hyperplasia. In this case a plan of treatment must be adopted with a view to remove this obstacle to clear phonation.

Aphonia due to Paralysis.

The most common cause of aphonia is paralysis of some of the muscles moving the vocal cords and employed in vocalization. Several varieties of paralysis of the cords are observed, such as unilateral paralysis or bilateral paralysis of the cords, paralysis of the abductors, or paralysis of the tensors and adductor muscles, or finally hysterical aphonia, in which at one time one set of muscles is affected, while at another time another set will refuse to act. All of these are classed under the common head of aphonia due to paralysis.

Symptoms.—If both vocal cords are affected, no sound whatever will be heard when the patient attempts to speak, except the accidental friction sound produced by the exhaled air striking against the projections in the cavities above the larynx. Laryngoscopic examination informs us that the vocal cords are relaxed and widely separated from each other, forming the glottis as we see it in quiet breathing. In many cases the cords are seen to make an attempt to approach each other when the patient essays phonation, but instantly fall back into

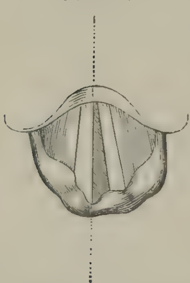
their original position. This is caused by the sphincter glottidis refusing to act while the crico-thyroid muscle momentarily stretches the cords.

In some cases of bilateral paralysis of the cords a faint fluttering noise is perceptible when the patient makes an effort to speak. The laryngoscopic mirror shows this to be due to an attempt at closing the glottis by the sphincter while the cords remain relaxed, not being stretched by the crico-thyroid muscle. In still other cases we notice a momentary stretching of the cords and a closing of the glottis, which, however, cannot be kept up by the affected muscles, and consequently no sound is produced.

Unilateral Paralysis.

If the muscles of one side only are affected, the cord on the other side is seen to move toward the median line, and is made tense, while the cord on the affected side remains relaxed, and applied to the wall of the larynx (Fig. 56). Here again, as in bilateral paralysis, we may have an action of the thyro-arytenoid, together with the arytenoid muscles, in moving the cords together, while the crico-thyroid on the affected side fails to stretch the cord; thus a peculiar hoarseness of the voice is produced, and the rima glottidis presents an opening of the shape of an Indian bow, the convexity of the curve being toward the affected side.

Fig. 56.



Paralysis of left vocal cord (Cohen).

If, on the other hand, the paralysis is only partial in both the sphincter and tensor muscles, the cord on the affected side moves toward its fellow sufficiently to be set in vibration ; being, however, not stretched to the same extent as the healthy cord, it vibrates less rapidly. This produces an irregularity of the air motion, which we perceive as noise or hoarseness of the voice. It frequently happens that the patient is hoarse in one part of his voice only, generally in the higher notes and not in the lower registers. This is due, if no inflammation or thickening of the cord exists, to the fact that the affected muscles may be strong enough to stretch the cords and keep them approximated as long as this does not require much force, as in the lower registers, but they are unable to perform their function when greater force is required. Thus it will be seen that upon the degree of the affection of the muscles depends the degree of aphonia due to paralysis.

Causes.—The causes of this affection of the vocal muscles are very diverse, and the prognosis in every particular case should be very guarded until their true nature is fully established. Paralysis of the cords may be caused by disease of the nerve centres, or of the branches supplying the nerve force to the muscles of the larynx; or it may be due to pressure upon the recurrent laryngeal branch of the pneumogastric nerve by tumors in the neck, such as goitre, sarcomatous infiltration of the thyroid gland, aneurism of the larger vessels, etc. It may also be due to inflammatory action and infiltration interfering with the exercise of the function of the muscles, and, if of long standing, this may cause atrophy of these

muscles; or it may be one of the symptoms of hysteria, which is, perhaps, the most frequent cause of aphonia in women; or, finally, it may be due to over-exertion and sudden failing or giving out of the contractile force of the muscle.

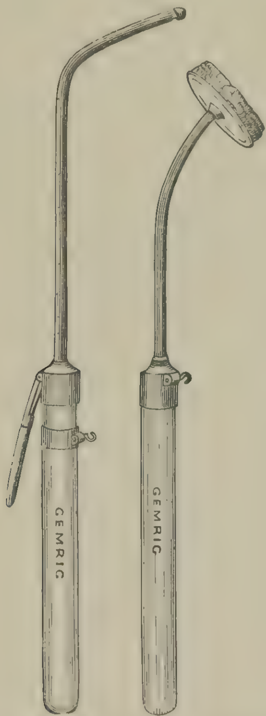
Treatment.—In all cases of loss of voice a careful examination of the larynx and the neck should be made in order to determine, if possible, the remote cause of the trouble, as upon the nature of this cause depends the tenor of the prognosis.

If disease of the nerve centres can be diagnosed by the presence of symptoms other than mere aphonia, the prognosis, of course, is very unfavorable, and the treatment should be directed to this systemic affection. If it is found that pressure upon the laryngeal nerve is the cause of the aphonia, this pressure, if possible, should be removed by operation. If inflammatory action is the cause, the treatment for chronic inflammations should at first be resorted to, and then the specific for local paralysis of the cords, viz., electricity, should be used, as it should be also in cases depending upon hysteria or caused by over-exertion of the voice. In the latter case, however, a strong solution of nitrate of silver applied to the cords often has a very beneficial effect by its stimulating action.

Electricity applied externally acts as a local tonic, and frequently is very beneficial in allaying an acute irritation, such as is produced by the application to the larynx of astringents in the form of powder, without interfering with their intended action. But in aphonia dependent upon paralysis this mode of applying electricity avails nothing, no matter how

long its use may be continued. To be of benefit, the current should in such cases go directly through the affected muscles. This may be accomplished by Mackenzie's laryngeal electrode (Fig. 57).

Fig. 57.



Mackenzie's laryngeal electrode.

This instrument is composed of a handle of glass, wood, or hard rubber, into which is screwed an insulated copper wire curved at the end and terminating in a small platinum ball. In order to prevent the current from passing through the electrode while

being introduced, the handle is furnished with an interrupter, a lever supported by a spring which is in metallic connection by a hinge with the wire at one end. The other end is furnished with a handle of some non-conducting substance, such as glass, bone, or rubber, for the purpose of affording a hold for the forefinger to depress the lever and keep it in contact with a metallic ring surrounding the handles, to which one of the connecting wires from the battery is attached. As long as the lever is kept down upon the ring, the current is passing, but is interrupted as soon as it is lifted by the supporting spring when the pressure is taken off. The other pole of the battery is attached to an ordinary electrode, and is given to the patient to press against the neck on one side or the other of the larynx. But as this is inconvenient, and the patient in the act of gagging frequently breaks the current by removing the pole from the skin, it has been found more convenient to connect this pole with a metal plate, which is covered with sponge, and which rests in contact with the skin upon the outside of the larynx, and is secured in that position by a band attached to the ends of the plate, and passing around the neck of the patient. In applying the electricity to the affected muscles, the plate is placed over the larnyx, the sponge having first been moistened with salt and water. Next the laryngeal mirror is introduced until a good view of the larynx is obtained. Then the electrode is quickly passed down until the platinum ball lies in the inter-arytenoid space. While introducing the electrode the finger must be kept off the lever, and contact must not be made until

the parts to be faradized are reached. In some cases, as, for instance, when paralysis of the arytenoid muscle alone can be diagnosed, both poles are introduced into the larynx. The instrument made for this purpose is very similar to the one just described. It has two covered wires instead of one, which run parallel with each other to within a short distance of their bulbed ends, when they separate so as to take the parts to be excited between them. The wires being flexible, the distance between the bulbs or balls can be increased or diminished as the case may require. Contact is made by the lever when the electrode is in position. Many patients can endure a comparatively strong current for a considerable length of time, but the instrument should invariably be withdrawn as soon as gagging sets in, for the bulb of the electrode is easily displaced by the convulsive movements of the larynx.

Internally tonics, and especially strychnia, should be given, for almost always the general health is impaired, partly by the cause of the paralysis itself, and partly by the mental anxiety caused by the loss of voice. In those cases of singers or public speakers in which hoarseness sets in after a short use of the voice, or in which the hoarseness or failing of the voice is due to the nervous excitement commonly called "stage fright," the preparations of coca erythroxylon, such as wine of coca or the fluid extract, have proved to be valuable voice stimulants when taken shortly before vocal exercise, and will, in many cases, prevent "stage fright." When the aphonia or hoarseness is due to general debility and inflammatory deposits in the tissues of the muscles, I have

found the following formula to be of great advantage:

℞.—Hydr. bichlor. corrosiv.	gr. $\frac{1}{3}$.
Acid. arsen.	gr. $\frac{1}{4}$.
Ferr. pyrophosph.	gr. vj.
Quin. sulph.	gr. xv.—M.

Div. in pill, No. xxiv.

Sig. One 3 times a day.

Exercise in the fresh air and pleasant mental diversion should be strongly advised. In hysterical aphonia the salts of bromine should be administered.

The duration of the disease is very uncertain. It varies with the cause and the length of time the loss of voice has existed before treatment was commenced. There are cases in which the aphonia, due to loss of contractility of the muscles, comes on suddenly, and is often removed by *one* application of the poles of the battery. In most cases not due to disease of the nerve centres or to pressure upon the laryngeal nerve, the voice returns gradually and slowly, and many applications are necessary to restore it. This is especially the case with aphonia due to hysteria, which often requires many months of patient treatment before any improvement is noticed. But, on the other hand, the voice in these cases often suddenly reappears, sometimes permanently, sometimes for a short time only. Females are more frequently affected in this way, but we find hysterical aphonia also in males.

Aphonia due to the Presence of Foreign Bodies.

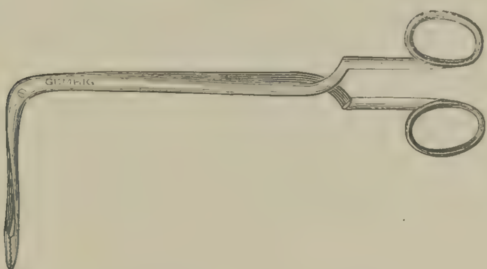
If the aphonia is due to the presence of a foreign body, accidentally introduced, it should be removed at once. Usually such foreign bodies are pins and fish-bones, which, with their sharp points, penetrate the mucous membrane, and are thus held in position (Plate I., Fig. 6), while other substances, such as buttons, seeds of various kinds, and small pebbles, if inhaled into the larynx, are either expelled by a fit of violent coughing, or fall down into the trachea or bronchi, whence they cannot be extracted. Of foreign bodies causing aphonia, pins are most frequently found, especially in women. The almost universal habit of putting pins in their mouths frequently leads to the sudden inhaling of one of them when the woman is startled. Fish-bones, usually of small size, as well as small splinters of bone, may enter the larynx while eating. An inspiration taken during the act of swallowing may cause a part of the food to enter the larynx, and a fit of coughing follows in order to expel the foreign body. This is commonly called "*food going the wrong way.*" If a bone thus enters the larynx, it is apt to become embedded in the soft tissues of this organ, when actual contact with the cords or the irritation and swelling of them cause aphonia. The same occurs when a pin has been inhaled. Occasionally we find bristles from a tooth-brush, pieces of straw, which some persons are in the habit of chewing, pieces of toothpicks, bristles from the ears of wheat, egg- and

oyster-shell splinters, etc., as foreign bodies. All these are, however, more commonly arrested before entering the larynx proper, and are most frequently found in the glosso-epiglottic folds or grooves, where by their piercing the mucous membrane they create an irritation which lasts for some time after the removal of the foreign body. It is, therefore, very common for persons to apply to a physician for the removal of a fish-bone, oyster-shell splinter, or piece of egg-shell, which on examination does not exist, but which undoubtedly had been there long enough to cause an irritation, and had either been removed, unnoticed by the patient, by coughing or in the act of swallowing. Under such circumstances it is often difficult to convince the patient that there is nothing in his throat but the irritation left by the foreign body, which will subside in a few days, and the practitioner is sorely tempted to practise a little fraud in order to obtain the patient's good opinion of his skill.

For the removal of foreign bodies from the larynx or fauces, as well as for the extraction of tumors in these cavities and in the nasal cavity, numerous instruments have been invented, some of which I will describe here before entering on the subject of neoplasms and their removal. The great desideratum in such an instrument is that it should be a pair of forceps curved at the end, that it should be strong enough to enable the operator to make traction without its slipping, and that its body should occupy as little room as possible. When the foreign body is lodged in the fauces or glosso-epiglottic grooves, and is not too tightly embedded, the already de-

scribed sponge-holder or epiglottis forceps answers admirably, but when the body is lower down or is tightly embedded, an instrument of different construction must be employed. The most useful kind of forceps is Sir Morell Mackenzie's common laryngeal forceps, almost exclusively used by him for the removal of neoplasms and foreign bodies from the larynx (Fig. 58). It is made of steel, with stout

FIG. 58.



Mackenzie's laryngeal forceps.

scissors-like handles, is of considerable length, and bent at right angles, terminating in spoon-shaped extremities, which open either laterally or antero-posteriorly. In the former, the pivot upon which the blades move is at a point between the handles and the bent extremities, while in the latter it is at the bend. It is necessary to have these two forms of instruments, since foreign bodies and tumors are frequently found in such positions that they can be grasped only with one or the other form of forceps.

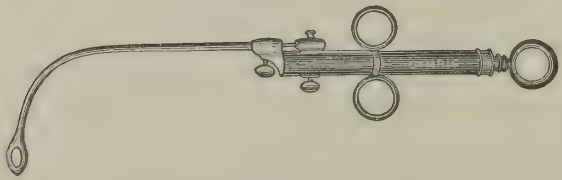
The spoon-shaped blades of the forceps are hollowed out, so that the opposing edges are sharp, and can be used for cutting off pieces of neoplasms grasped between them. In another form, which is

designed expressly for the removal of foreign bodies, the blades are solid, and the opposing surfaces ribbed, so as to prevent slipping. In still another form, only one of the blades is hollow, with cutting edges, while the other presents to it a smooth surface.

The introduction of these forceps is somewhat difficult on account of the sharp bend, and the length of the extremities, but it has been found that this form is more useful in a greater number of cases than the curve employed in other instruments designed for the same purpose.

The French and German laryngoscopists use what are called "*tube-forceps*," and among them that designed by Prof. Stoerk, of Vienna, is perhaps the most useful of all (Fig. 59). It consists of a univer-

Fig. 59.

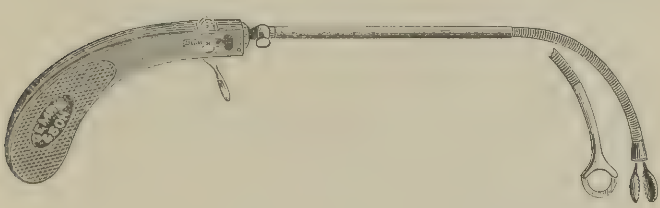


Stoerk's guillotine and tube-forceps.

sal handle, into which a number of different forceps, slings, and cutting instruments can be inserted. The forceps used in this handle is made of a tube of metal, so curved at its extremity that its end can reach the vocal cords without difficulty. Within this tube is a thin flexible steel wire, to the end of which two blades are attached, projecting beyond the end of the tube, and having ribbed surfaces. These blades are separated by a spring concealed

within the tube, and are approximated by retracting them within the tube. This retraction is effected by means of a slide attached to the universal handle; to this slide the end of the wire carrying the forceps blades is fastened, while the tube is inserted into the handle itself. Sometimes it happens that a tumor or foreign body is in such a position that neither a laterally nor antero-posteriorly opening forceps can be employed. For such cases a wire loop, extending from the extremity of another tube secured in the universal handle, will be found very useful. The loop can be thrown around the tumor or foreign body, and then, by making traction upon the ends of the wire secured to the slide of the handle, it can be grasped and removed.

FIG. 60.



Seiler's universal tube-forceps and guillotine.

Foreign bodies and neoplasms are frequently situated in such a position that neither an antero-posteriorly nor laterally opening forceps will readily grasp them, and it becomes a very difficult matter to remove the foreign body or neoplasm. In order to obviate this difficulty, and to obtain a forceps which could be adapted to every case, I had a forceps made of the following description (Fig. 60):

A piece of stiff tube, about three inches in length, is attached, by means of a bayonet-joint, to a wooden handle shaped like the butt of a pistol. To the end of the tube is attached a close spiral of steel wire, also about three inches long, terminating in a bell-like end-piece. Within this partially flexible tube slides a stout copper wire, to one end of which are attached the blades of the forceps, while the other end is securely fastened to a slide within the handle, which is moved by means of a trigger-like projection. Thus, by pulling the trigger the wire is drawn backward, and the blades of the forceps are closed. Both the wire and the anterior portion of the tube being flexible, any desired curve can be obtained, and the blades of the forceps may be made to open in any direction. This spiral tube-forceps I had at first attached to the Stoerk universal handle, but have found the pistol handle to be not only more convenient, but also cheaper.

Several other forms of open or tube-forceps are in use which are similar in principle to those described, and differ from them only in minor details. As a matter of course, the same size of forceps will not answer for all cases, and different shapes and sizes should therefore be kept ready for use.

CHAPTER X.

NEOPLASMS OF THE LARYNGEAL CAVITY.

Use of Instruments.

Besides the forceps described in the foregoing chapter, cutting instruments are frequently used in operating for tumors in the laryngeal and nasal cavities.

Formerly, when laryngoscopy was in its infancy, and laryngeal surgery was only beginning to be made use of, so-called open laryngeal knives were used, especially by von Bruns, of Tübingen, who claims to have been the first to remove a tumor, or, at least, perform a surgical operation in the laryngeal cavity. Such an open knife consists simply of a curved steel wire, secured in a handle, and terminating in a knife blade, either sharp- or blunt-pointed. This knife blade, which is very narrow, must have its cutting edge either laterally or antero-posteriorly, so that incisions may be made either transversely or longitudinally to the axis of the glottis. In order to be able to cut both forward and backward and from side to side, the blade is made with a cutting edge on either side, like a dagger. The introduction of such an open knife into the larynx is, of course, rather hazardous, inasmuch as the epiglottis or the posterior wall of the pharynx or the tongue would be easily wounded if the patient should gag

and the knife have to be removed quickly. The laryngeal knives now in use are, therefore, covered (Fig. 55)—that is, the blade is contained in a curved tube, like the one used for the tube-forceps, from which it can be protruded by means of a lever upon the handle, which either retracts the tube from over the knife blade, or pushes the latter out of the tube when the instrument is in position and the incision is to be made. As soon as gagging sets in, the pressure upon the lever is taken off, and the knife is instantly concealed within the tube, so that no harm can be done to any of the parts in removing the instrument.

Mackenzie's forceps must be regarded as cutting instruments, inasmuch as the blades have cutting edges and act like nippers.

Stoerk has attached to his universal handle (see Fig. 59) a very ingenious cutting instrument called a guillotine, which is the safest and most useful of all instruments of this class. It may be looked upon as a combination of the wire loop and the covered knife, since it consists of a permanent loop with an inner cutting edge, or, in other words, an annular knife. This, like the tube-forceps and the covered knife, may be retracted into an expanded and flattened extremity of a curved tube, and by this motion will cut off as much of a tumor as can be pressed through the opening of the knife blade. In order to shave close to the surface of the mucous membrane or the edge of the vocal cords, the blade is ground flat on one side and hollow on the other. This, of course, necessitates the employment of a right and a left blade, and an anterior and a posterior

blade. The former and the latter pair can each be inserted into the same tube; thus it is necessary to have four blades and two tubes. This guillotine may also be used in connection with the flexible spiral tube, and attached to either the Stoerk handle or to the handle of my forceps (see Fig. 60), and as it can be bent in any direction, only one knife is necessary, instead of four, as in the original instrument.

With this instrument, when once introduced into the larynx, a tumor projecting, for instance, into the glottis and attached to the edge of one of the cords, can be surrounded and cut off by the knife even when the patient gags and struggles, inasmuch as no part of the larynx can be injured by the knife. There are, however, cases in which none of the instruments existing is applicable, and the ingenuity of the operator is called upon to devise modifications so as to adapt the instrument to the requirements of the particular case, or, if this cannot be done, to invent a new instrument altogether.

Besides the forceps and knives for the removal of tumors and foreign bodies from the larynx, an exploring instrument should be used in order to ascertain the consistency of a tumor, its attachment to the mucous membrane, whether by a slender stem or by a broad base, etc., and for various other purposes. Such an instrument is called a laryngeal sound or probe. It has already been described as consisting of a piece of silver wire, bent to the proper curve and held in a mirror handle. In most cases it serves its purpose of exploring very well, but in some instances, where it is necessary that a tumor should be lifted up in order to ascertain its location

and mode of attachment, the end of the probe must be bent into the shape of a hook.

Neoplasms.

Symptoms.—Besides the aphonia, which, in neoplasms, is of a peculiar character, inasmuch as the voice, which is usually hoarse, or sometimes quite natural, is lost suddenly and completely for a few minutes, and then returns as suddenly, often with a change of position of the head or body of the patient, we frequently observe dyspnœa. Dysphagia, on the other hand, is rarely met with, and only occurs when the tumor is so large as to interfere with the movement of the epiglottis, or when it springs from this organ. Pain is rarely observed, and usually attends only malignant growths of the larynx. Cough, as a rule, is one of the symptoms of laryngeal tumors. Slight in most cases, but severe and harassing in a few, it is generally of a peculiar character, resembling the cough in croup, and is apt to come in paroxysms. The character, location, shape, and size of neoplasms in the larynx which may produce the foregoing symptoms are very varied. According to Mackenzie's statement, they occur most frequently upon the vocal cords, but may be found in almost any part of the larynx. (Plate I., Figs. 4 and 5.)

Diagnosis.—The diagnosis, as regards the presence of a tumor in the larynx, is very certain, if a careful laryngoscopic examination can be made, and the only sources of error are the eversion of the ventricle, an exceedingly rare occurrence, in which the mucous membrane lining the pouch protrudes like

a tumor between the vocal cord and the ventricular band. The second source of error is an infiltration and consequent swelling of the ventricular bands, which in that condition may hide from view a small tumor situated in the vocal cord or on the lower surface of the ventricular band itself.

Classification of Tumors in the Larynx.

Clinically, the tumors met with in the larynx are divided into two great classes. In the one are those which, after thorough operative removal, do not usually return; in the other are those which will return, if not at their former seat, at some other part of the body, even after the most careful removal of all diseased tissue. The former have received the appellation of benign tumors, the latter that of malignant tumors. It is, however, exceedingly difficult at the present time to draw the line of distinction between these two classes; even when a microscopic examination has determined the nature of a growth, it is often impossible to say whether a tumor is benign or malignant, because neoplasms, which formerly were regarded as perfectly harmless, have been known either to return after operation, or to change their character from a benign to a malignant form.

The tumor most frequently met with in the larynx is the *papilloma*, or wart-like growth, which springs from the mucous membrane lining the larynx. It assumes various forms, all more or less indented on their surface. This indentation has given rise to the variety of names which this kind of neoplasm bears,

such as cauliflower, raspberry, mulberry, foliated, etc. These growths are usually attached by a broad base, and only occasionally do we find them pedunculated. Their size varies from that of a mustard-seed to that of an English walnut, but is usually that of a good sized pea. Their color is mostly pink, but sometimes white or bright red. A thin section of such a growth presents under the microscope the appearance of hypertrophied papillæ of the skin or mucous membrane.

The next in frequency of occurrence is the *fibroma*, a tumor usually pedunculated, pinkish or red in color, round and sometimes irregular or wavy in outline, with a smooth surface, hard and unyielding to the touch of the sound. Its size varies from that of a small seed to that of an acorn, and is most frequently found to spring from the vocal cords.

Less frequent are the *fibro-cellular* tumors. They are usually found on the vocal cords, about the size of a pea, red or pinkish in color, sessile, with a smooth surface, and of a more or less globular shape.

Still more rarely met with are the *myxomata*, which in appearance resemble the fibromata, except that they are soft and yielding to the touch.

Only one case of *lipoma* or fatty tumor in the larynx has been reported (von Bruns).

Cystic tumors, on the other hand, are more frequent, and resemble the fibrous tumors in shape, size, and color. They differ from them, however, in their mode of attachment, which is always broad. Their consistence depends upon the material with which they are filled, whether serous, caseous, purulent, etc. They also usually have a zone of irritation

around them, and occur most frequently on the laryngeal surface of the epiglottis.

Fasciculated sarcomata and *adenomata*, or glandular tumors, show no distinctive features, but may resemble any of the above-described neoplasms. They are very rarely met with in the larynx.

Vascular growths, or *angiomata*, also are very rare, and may be diagnosed by their dark, almost black, color, and granular surface, as well as by their tendency to bleed on being touched.

The so-called malignant growths found in the larynx are usually secondary deposits from a primary cancer elsewhere, and show the distinctive features of the primary growth. This is, however, not invariably the rule, as a considerable number of cases of primary cancer of the larynx have been reported, some of which have been successfully treated by extirpation of the whole organ or part of it. The most frequent form of cancer in the larynx is *epithelioma;* next in frequency are found, in the following order, *round-celled sarcoma*, *spindle-celled sarcoma*, *medullary carcinoma*, and *scirrhus*.

All of these are infiltrating and ulcerating, and give more the appearance of a localized tumefaction than of a new formation projecting into the laryngeal cavity.

Treatment.—Tumors in the laryngeal cavity producing by their mechanical interference aphonia, dyspnœa, dysphagia, and other symptoms already described, should, if possible, be removed by means of forceps or cutting instruments, and the seat of the neoplasm should be cauterized with solid nitrate of silver, or the galvano-cautery knife, to prevent a

local return of the growth. In cases of secondary cancerous deposits in the larynx it becomes a difficult question as to whether surgical interference should be attempted or not. It is, however, always advisable in such cases to tear off a small piece for microscopic examination, so as to determine the precise nature of the growth. If, however, there is the hope of obtaining by operation even a slight temporary relief from the harassing symptoms, as much as possible of the growth and infiltrated tissue should be removed, even if partial or total extirpation of the larynx becomes necessary.

In the removal of a tumor from the larynx, its position, size, mode of attachment, whether pedunculated or sessile, its vascularity, consistence, and other peculiarities, must be taken into consideration, in determining what mode of operation is to be adapted to the case.

Almost all patients suffering from neoplasms in the larynx require to be accustomed to the presence of an instrument in the laryngeal cavity by frequent introductions either of the instrument to be used in the operation or of the laryngeal sound, and it often requires weeks and months of daily practice before the removal of the tumor can be executed with safety. If, however, the removal of the tumor or foreign body is very urgent to prevent suffocation, and the patient's throat is too irritable to allow of instrumental interference, anæsthesia of the larynx may be tried before resorting to tracheotomy. This method of reducing the sensibility of the larynx was first recommended by Rossbach, and consists in freezing with the ether spray a portion of the skin

on either side of the neck near the position of the lesser horns of the hyoid bone, with a view to affect the superior laryngeal nerve, which at this place comes near the surface. In several instances I have succeeded in rendering the larynx almost completely insensible to the presence of an instrument, but in other cases have utterly failed to obtain the desired result. A fine spray of a four per cent. solution of cocaine thrown into the larynx by means of an atomizer is a more convenient and reliable method of producing local anæsthesia of the laryngeal mucous membrane, and enables the operator to introduce the forceps without previous training in the majority of cases. Yet there are some persons in whom even the cocaine spray does not produce the desired result, and who must be educated to allow the introduction of the instrument into the laryngeal cavity without contracting the superior laryngeal opening.

In cases where dyspnœa exists to a considerable extent, on account of the tumor being so large as to interfere with the free ingress and egress of air, tracheotomy should be performed at once, as the patient is in imminent danger of suffocation. In most cases of asphyxia caused by laryngeal growths, it is not the tumor which suddenly closes the glottis and thus prevents respiration, but this closure is usually produced by spasm of the adductor muscles of the larynx approximating the cords, and its immediate cause is some slight irritant, such as dust, carbonic acid gas, ether, etc. If the tumor is attached to the free edge of the vocal cord or ventricular band, either by a broad base or a narrow stem, and if it is not too large, it can frequently be gotten

through the fenestrated knife of the guillotine, and extracted in spite of the gagging and struggles of the patient. When the open or covered knife or even the forceps is to be used, the patient should be so trained that no amount of instrumental interference will produce gagging.

Prognosis.—The prognosis, as regards the local return of a tumor, depends altogether upon its nature, which can only be determined with accuracy by careful microscopical examination. Yet even the benign papilloma has, in some cases, a tendency to return after it has been thoroughly removed, particularly in children, and the process of picking off the neoplasms has to be continued often for a long period before the larynx is entirely and permanently cleansed of the tumors.

CHAPTER XI.

PHARYNGITIS.

Pharyngitis is an inflammation of the mucous membrane lining the pharynx, and, like laryngitis, is divided into two large groups, the *acute* and *chronic*. These are again subdivided according to the causes producing the inflammation, and according to special features characteristic of the different forms.

Acute Pharyngitis.

Acute pharyngitis is found in connection with acute laryngitis and usually precedes it, the velum

palati, the pillars, and tonsils participating in the general inflammation of the mucous membrane. This condition is the so-called sore throat so common among children as well as adults.

Symptoms.—This affection is usually caused by wet feet, an exposure to cold draught, etc. It is ushered in by a more or less pronounced chill. Febrile symptoms then begin to show themselves, more or less severe according to the effect produced by the exciting cause upon the general system. The throat feels raw, swollen, and painful, deglutition becomes painful and difficult on account of the swelling of the tonsils, palate, and uvula, and a thick yellowish expectoration is thrown out. In the first stage there is usually little or no cough; but later, when the inflammation has extended into the larynx and perhaps even into the trachea, the cough becomes very harassing. The lymphatic glands under the jaw and in the neck usually participate in the general inflammation and become swollen and painful to the touch.

On inspection of the pharynx, which is easily effected by depressing the tongue by means of a tongue-depressor, we find the anterior pillars red and swollen, and the tonsils of a purple hue, protruding beyond the anterior pillars (Plate II, Fig. 2), thus hiding from view the posterior pillars of the fauces. Frequently small white patches of cheesy consistence, easily removed with a probe, but leaving no ulcerated surface underneath them, are observed on the tonsils, especially on the posterior surface. These patches are the hardened secretions of the follicles in the glands, pressed out by the

swelling of the organs. They differ, however, from pseudo-membranous patches as seen in diphtheria, inasmuch as they are usually smaller, of different consistence, and leave no ulcerated or raw surface when removed. But they are frequently mistaken for diphtheritic exudations, and the affection is then after a hasty and superficial inspection called diphtheritic sore throat. It sometimes occurs that these cheesy patches are mistaken for the pus-covered surfaces of ulcers, and the patient is then subjected to severe treatment in order to heal up the supposed ulcers.

The velum palati is uniformly reddened and swollen, while the uvula is generally relaxed and hangs down into the pharyngeal cavity. The wall of the pharynx is seen to be bright red, with prominent veins fully injected ramifying over its surface, which is either glistening and shiny or studded with enlarged and inflamed follicles or glands. The free margin of the epiglottis is usually swollen from the first.

Duration.—The duration of this affection is usually of a few days only, when the swelling and inflammation subside, and the normal condition of the parts becomes reëstablished; if, however, the larynx is affected to any extent, the disease is prolonged by this complication, and may continue as an acute laryngitis after the inflammation of the pharynx and tonsils has subsided. But this is not usual, and does not occur in vigorous subjects, or when proper and active treatment has been adopted from the beginning of the affection. Of late, a form of acute pharyngitis has been observed, which differs in many

respects from the ordinary disease, inasmuch as it is epidemic and infectious, without being contagious. Its most prominent features are a mucoid infiltration of the submucous tissue, the formation of small patches of pseudo-membrane which is white and does not curl up at the edges even after a number of days, and when pulled up does not disclose any ulceration of the mucous membrane beneath it. Various forms of neuralgic pains, and particularly otalgia, are present and are often very severe. At the onset very little systemic disturbance is noticed, but later on the pulse becomes weak and more rapid, and a slight rise in temperature becomes noticeable. Its duration may be from a few days to several weeks, and even months, without apparent change from treatment.

Treatment.—The treatment should be directed to the removal of the general febrile symptoms, and to hastening the resolution of the local inflammation, as well as to the alleviation of the pain.

Saline purgatives, hot foot-baths, and sponging the body with tepid water or whiskey and water, should first be resorted to, and the diet reduced to milk, mush, gruels, and, if necessary, beef tea. All articles of food should be soft, and of the mildest nature. Spices, even in very small quantities, aggravate the local symptoms. Frequently the tumefaction of the parts is so great as to make the act of deglutition almost impossible; then only iced milk or oyster soup can be swallowed in very small quantities, and the thirst must be alleviated by small pieces of ice held in the mouth. All beverages con-

taining carbonic acid should be avoided, as the gas increases the inflammation and pain.

In this affection only are gargles of any use. They can be easily brought into direct contact with the parts most affected, namely, the soft palate with the uvula, the posterior wall of the pharynx, the tonsils, and pillars. Strong solutions of alum, tannic acid, benzoic acid, Labarraque's solution in strength of 1 to 5, iron, and other astringents should be employed in the form of gargles in combination with some anodyne, or the parts should be irritated with them by the spray from the hand atomizer, or they may be painted with a brush over the surfaces most inflamed. Solutions of nitrate of silver applied to the apparent centres of inflammation act with great promptness in reducing the swelling, except in the mucoid variety, in which it seems to have no effect whatever. An attack of this kind can frequently be cut short or prevented altogether by the early use of this remedy, provided a sufficiently strong solution be used. It has been my experience that weak solutions (fifteen to thirty grains to the ounce of water) rather increase the inflammation and pain, while a sixty, eighty, or even one hundred and twenty grain solution has an anæsthetic effect, and reduces the inflammation if applied before any inflammatory infiltration into the submucous tissue has taken place; that is, within a few hours from the start of the disease. Vapor inhalations of carbolic acid, benzoin, tar, etc., are also very advantageous. Internally, the mixture of iron, chloride of potash, and bromide of potash, in liquid form, or in the form of lozenges, recommended in the treatment

of acute laryngitis, has been found to give the most satisfactory results in allaying the irritation. Poultices of various substances applied externally to the neck tend to keep the skin soft and pliable, thus diminishing the painful pressure upon the enlarged glands. If the inflammation has been very severe, and the swelling very great, suppuration and ulceration may occur.

One attack of acute pharyngitis predisposes the patient to other attacks of the same kind, and we frequently have occasion to observe the great regularity with which the affection returns once or twice a year in the same person. It has been found that bathing the throat with cold water every morning and evening throughout the whole year, and hardening the skin against atmospheric influences by moderate exposure, even in cold weather, will frequently break up the tendency to acute pharyngitis and tonsillitis.

Traumatic Acute Pharyngitis.

As has been said, the common cause of the affection is exposure to cold, but the accidental or intentional swallowing of corrosive or very hot liquids will produce the same results, as well as the embedding of sharp foreign bodies in the tissues, such as fish-bones, splinters of bone or wood, pins, etc. In the latter case the inflammation starts from a point of irritation spreading over the whole mucous membrane covering the parts in the neighborhood. The first step in the treatment should, of course, be the removal of the offending body.

An acute pharyngitis without involvement of the soft palate and the tonsils is exceedingly rare, and is only found when the irritation has started in the pharynx and has not had time to advance to the parts above. It was, therefore, necessary to describe two affections together, viz., acute pharyngitis and acute tonsillitis, which are differentiated from each other by their names only, while not different in reality.

The chronic forms of these two affections, on the contrary, differ widely from each other, both as regards their causes and the symptoms which they present; they will, therefore, be considered separately.

Chronic Pharyngitis.

It has been the experience of most laryngologists that the ordinary forms of chronic pharyngitis, such as the so-called granular, follicular pharyngitis, pharyngitis sicca, and so forth, are merely symptomatic expressions of chronic diseases of the nose and naso-pharynx, or of gastric irritation, and are, in reality, not entitled to be considered as separate diseases, inasmuch as these heretofore called chronic pharyngites disappear without treatment, with the removal of the cause which produced them. I will, therefore, in this edition, consider the symptoms to which they give rise, together with those due to naso-pharyngeal disease, and describe in this chapter only the specific pharyngitis and the chronic pharyngitis due to traumatism.

Specific Chronic Pharyngitis.

Secondary, as well as tertiary, syphilis produces a form of chronic inflammation in the mucous membrane of the throat which has sufficient distinctive features to entitle it to be considered under a separate head.

Symptoms.—The patient complains usually of a slight cough with thick yellowish, but scanty, expectoration, of a fulness and dryness of the throat, and of more or less hoarseness of the voice. Often difficulty of deglutition is complained of, and frequently articulate speech has a nasal quality. On inspection we find the mucous membrane of the pharynx, soft palate, uvula, and tonsils of the peculiar brick-red hue already described under the head of Specific Laryngitis. The pharynx is dry and glistening, and ulcers more or less deep, of a rounded outline, with raised edges, and surrounded by a zone of more active inflammation, may be found almost anywhere. They are, however, most frequently seen on the pharyngeal wall, the soft palate, the pillars and tonsils, and often on the tongue. Symmetrical patches of more active inflammation are almost always seen in specific inflammations of the throat, and form one of the distinctive features of this affection. (Plate II., Fig. 4.)

Gummata or syphilomata are often observed on the posterior wall of the pharynx, and may be recognized by their peculiar elasticity to the touch of the sound. An adhesion of one or both posterior pillars to the pharynx is also frequent, and is caused

by cicatricial tissue resulting from the healing of ulcers. These features are so peculiar that when once seen they will always be recognized, and a confirmation of the diagnosis by the history of a primary sore is frequently unnecessary.

Treatment.—The treatment of the local affection must consist in stimulating the mucous membrane so as to remove the dryness and swelling, and in healing up the ulcerations if such are present. This is done by cauterizing them thoroughly with nitrate of silver if they are of the shallow kind, or by galvano-cautery followed by acid nitrate of mercury, if they are of the deep and destructive variety, in the manner already described in the chapter on Syphilitic Laryngitis. It frequently occurs that these ulcers perforate the velum palati or even the hard palate, and then the peculiar nasal twang of the voice is heard. The progress of these perforations may be stopped by cauterization, but they cannot be closed except by a plastic operation when the edges have healed, or by fitting a plate with an elastic flap over the perforations.

The constitutional treatment must, of course, not be omitted, for no amount of local applications will eradicate the disease. I have, however, found that iodide of potassium, in small doses, is preferable to mercury in these cases, and I am in the habit of always giving the iodide of potassium in combination with bromide of potassium, because the one seems to enhance, and, at the same time, control the action of the other, so that they can be taken for a longer time in combination than when given separately, before producing a disturbance of digestion

and eruption on the skin. A dose of from three to five grains of the iodide of potassium and ten grains of the bromide of potassium, given three times a day, is often borne for months without signs of iodism. The ulcers in the throat heal rapidly, and the mucous membrane assumes its normal condition under such treatment.

The general health of the patient should at the same time be attended to by the administration of tonics, cod-liver oil, and salt baths, and he should be advised to take exercise in the fresh air.

Traumatic Chronic Pharyngitis.

After the ulcers or the acute inflammation produced by the accidental swallowing of hot or caustic liquids, causing acute traumatic pharyngitis, have passed away, a chronic inflammation of the mucous membrane is frequently left behind, which exhibits the same symptoms and appearances of the parts as have been described when treating of simple chronic pharyngitis. The treatment required for this form does not differ from that for other forms of the disease.

CHAPTER XII.

ELONGATED UVULA AND HYPERTROPHY OF TONSILS.

There are two conditions which, strictly speaking, do not come under the head of disease of the throat, but which, on account of the symptoms they pro-

duce, are generally considered as such; these are elongated uvula and hypertrophy of the tonsils.

Elongated Uvula.

Elongation of the uvula is due either to genuine hypertrophy of the tissues of this organ, to dropsical effusion, or to simple relaxation of the soft palate and uvula, thus causing the latter to hang down into the laryngeal cavity during breathing, or to come in contact with the margin of the epiglottis and posterior wall of the pharynx, as well as the back of the tongue.

Symptoms.—The symptoms produced by a relaxed condition of the uvula are principally a tickling in the throat, and consequent cough and gagging, especially when the patient assumes the recumbent position. Very little or no expectoration is observed to follow the cough. The voice has a very slight nasal sound, and sometimes a peculiar *jarring* noise accompanies the vowel sounds. On inspection the mucous membrane is usually healthy, or slightly paler than normal, and the uvula is seen either to lie upon the back of the tongue, or to hang down so that its end cannot be seen until the patient draws up the velum palati in the effort to pronounce the vowel "*eh.*" If the elongation is due simply to a relaxation of the loose submucous cellular tissue the organ is often seen to adhere to the wall of the pharynx or to the pillars; but when it is due to true hypertrophy of the body, the uvula hangs down rigidly and feels hard and resisting to the sense of touch. Sometimes we meet with cases of bifid uvula,

and it often happens that one of the branches is relaxed, while the other is not (Plate II., Fig. 3).

Treatment.—The treatment of the former condition, if of recent origin, and especially in children, consists in the application twice or even three times daily of strongly astringent solutions, such as tannic acid, alum, sulphate of zinc, and especially of the tincture of iron, to the elongated uvula by means of the brush. If such applications be continued for a considerable length of time, the uvula can gradually be made to assume its natural condition.

If the elongation is due to serous effusion, as can be determined by the peculiar club-shape which the uvula assumes, a few incisions into its integument often effect immediate cessation of all symptoms.

The cases, however, in which the relaxation has lasted for some time, and is not due to dropsical effusion, but to true hypertrophy, refuse to yield to astringent treatment, and amputation of the uvula is the only proper mode of treatment. This may be done by means of a pair of scissors and forceps in cases where the patient is willing and determined to have the operation performed. The forceps should grasp the end of the uvula so as to prevent its slipping back, and to prevent also its falling into the larynx after it has been cut off by the scissors as near to the root as possible. The pain and hemorrhage in this operation are very slight; indeed, not infrequently altogether absent. The wound usually heals by first intention within two or three days, the patient in the meanwhile being fed on soft food. As a rule, the hemorrhage following the operation is very slight and hardly noticeable; but there are some

cases on record, as pointed out by Dr. Caroll Morgan, of Washington, in which the bleeding was profuse, and could not be controlled by ordinary styptic applications. In one case Dr. Morgan compressed the stump of the uvula with a clamp from the common shirt-sleeve retainer, as the only means of stopping the hemorrhage.

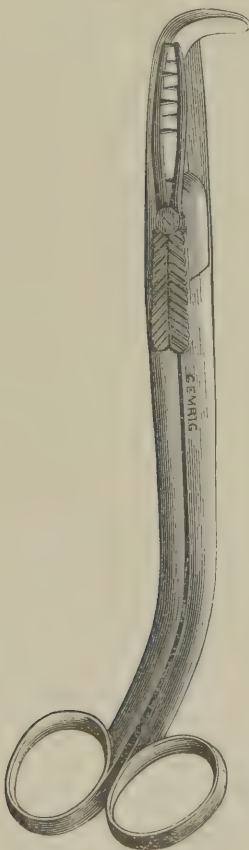
In children it often becomes a matter of some difficulty to introduce two instruments into the mouth in order to clip the uvula, and in such cases it is better to use an instrument called a uvulatome, which combines both the forceps and the scissors in one instrument.

Uvulatomes.—Various forms of instruments combining the forceps with the cutting instrument have been introduced, but they all have such disadvantages that most operators prefer to use the forceps and scissors separately, even if they have to struggle with the patient, and can perform the operation but unsatisfactorily.

Having frequent occasion, in dispensary work, to perform the operation, I endeavored to construct an instrument which would obviate the difficulties attending the use of such uvulatomes. I had, therefore, an instrument made which consists of a pair of strong scissors, the handles of which are bent so that the hand holding them is below the mouth of the patient when the uvula is grasped. The right blade is bent at right angles, forming a hook at its end, while the left blade is pointed, and reaches to the upper margin of the bend of the right blade. Thus when the blades are separated, a triangular opening is formed, into which the uvula can drop and be cut

near its root, the hook-like bend of the scissors preventing its slipping backward out of the grasp of

FIG. 61.



Seiler's uvula scissors.

the instrument. Upon the same pivot upon which the blades of the scissors revolve are attached a pair

of pronged claws lying on the under surface of the scissors blades; they serve to catch the amputated piece (Fig. 61). With this instrument no difficulty will be experienced in grasping and cutting the uvula even if the patient should struggle, since the handles of the scissors are held so that the pressure of the fingers in closing them keeps the blades in close contact with each other.

Hypertrophy of Tonsils.

An acute inflammation of the tonsils, exhibiting the different symptoms of inflammation elsewhere, is of frequent occurrence. It may be either simple or complicated with an acute pharyngitis or laryngitis, under which head it has already been described; it remains, therefore, only to describe the symptoms and treatment of chronic tonsillitis or hypertrophy of the tonsils.

Clinically, we observe three varieties of hypertrophied tonsils, viz.: first, the ordinary soft variety of childhood and early youth, which consists histologically of a hyperplasia of the cellular elements of the glands, with a slight increase of the intercellular connective tissue. This variety usually disappears spontaneously shortly after puberty, and in strumous individuals is frequently the seat of acute periodical inflammation, which may or may not go on to the development of tonsillar abscess. The second variety is the so-called scirrhous tonsil, first mentioned by Jarvis, which is characterized by an enormous increase of the intercellular connective tissue, and a canaliculization of the bloodvessels of the gland,

giving the tonsil a hard, almost cartilaginous feel to the touch. This form is usually met with in young adults, and is rarely, if ever, the seat of acute inflammation. And, finally, the third variety, the so-called ragged tonsil, which is the result of frequent tonsillar abscesses, causing the sloughing away of portions of the tonsillar tissue, so as to leave a ragged glandular mass, which projects beyond the faucial pillars.

Symptoms.—The symptoms of hypertrophy of the tonsil are more passive than active; that is to say, there is usually no pain or active inflammation. There exists, however, more or less obstruction to the passage of the air in breathing, which causes the patient to snore when asleep. The articulation is what is called "thick," and more or less difficulty of deglutition is observed. The degree of obstruction to breathing being dependent upon the amount of swelling of the glands, the latter may lead to alarming symptoms of dyspnœa, especially in children, when an acute coryza obstructs the nasal passages. Usually these hypertrophied glands are the seat of periodical acute inflammations, causing a great deal of suffering to the patient. In many cases of the first variety, the crypts of the glands are filled with a hardened secretion, which is of a white color and of cheesy consistence. In some cases this retained secretion undergoes putrefaction, and thus gives rise to a most disagreeable odor, which is imparted to the breath of the patient.

Treatment.—In treating hypertrophied tonsils we may with propriety look upon them as tumors or neoplasms. Like enlarged glands elsewhere, they

may be reduced by the application of astringents, which must be, however, of a very active sort, such as strong solutions of nitrate of silver or of the solid lunar caustic; iron and tannic acid have but little effect, even when the applications are frequently repeated and continued for a long time. Application of the tincture and solution of iodine to hypertrophied tonsils has been recommended, but is apt to cause unpleasant results by producing spasm of the glottis by reflex action. Injection of solution of iodine into the substance of the gland by means of a hypodermic syringe, however, is often followed by a speedy reduction of the tonsil without causing the unpleasant results that are apt to follow the application of the drug to the mucous membrane.

The best and most satisfactory way of treating hypertrophied tonsils is to cut them off as close to the pillars of the fauces as possible. In the ordinary soft variety the tonsil is best removed by ablation with the tonsillotome. Care should, however, be taken not to wound the edge of the anterior pillar, because a small branch of the tonsillar artery runs close to this edge, and when cut gives rise to hemorrhage difficult to control. If the anterior pillar is adherent to the tonsil, it should be loosened, and if this is not possible, owing to the bands of fibrous tissue connecting the pillar with the tonsil being too strong to be torn, the tonsillotome cannot be used with any degree of safety, and the galvano-cautery knife should be used. After the projecting portion of the tonsil has been ablated, the cut surface should be brushed over with a sixty-grain solution of nitrate of silver to cause contraction of the capil-

laries and to cover the wound; and any secondary hemorrhage, which, however, rarely occurs, should be controlled with a strong solution of tannic and gallic acid used as a gargle. The old method of removing the tonsils with the volcellum and bistoury is unsafe, as the edge of the anterior pillar, even when not adherent, is too easily wounded by the heel of the knife. Total extirpation or enucleation is also dangerous, besides being unnecessary except in the extremely rare cases of cancerous growth in the tonsil. There are several kinds of tonsillotomes in use, the older form invented by Fahnestock, and later improved forms.

Fahnestock's tonsillotome (Fig. 62) consists mainly of an annular knife, which moves in a split ring, through which the enlarged tonsil is pushed, and of a stout needle attached to the instrument in such a way that it can be pushed forward, thus transfixing the gland and preventing its slipping out of the ring. When thus secured, by pulling out the handle of the tonsillotome the protruded parts are cut off with the annular knife. It will be seen that in order to use this instrument both hands are needed, and two motions must be executed, viz., the pushing back of the needle and the pulling forward of the knife.

Another instrument requiring but one hand and one motion in its use, is figured in Fig. 63. It is very similar in construction to Fahnestock's instrument, and differs from it only in the fact that the stylus or needle is replaced by a fork which, after having penetrated the tonsil, is raised, thus drawing it through the ring. The annular knife is prevented, by a catch at the stem of the instrument, from mov-

ing until the tonsil has been pierced and drawn into the ring. This catch is lifted and the knife is drawn down, cutting through the protruding tonsil with the same motion of the hand that was employed to push the fork forward.

The original instrument was invented by Mathieu, of Paris, but the author has found the ring too large to be introduced into the mouth of children, and even of the average adult. Furthermore, the long diameter of the ring is in this instrument at right angles to the shaft, which prevents the surrounding of the hypertrophied gland in most patients. By slightly reducing the size of the ring and having its long diameter in the axis of the shaft, the instrument becomes one of the most serviceable in the greatest number of cases. Another modification of this instrument consists in having several sizes of rings with annular knives attachable to the shaft, which can readily be exchanged for each other to fit the different cases. This modification was borrowed from an old German instrument, but it is too complicated and costly to come into general use.

The safest and only applicable one in cases of ragged tonsil is the galvano-caustic method of removing hypertrophied tonsils. In applying this method the galvano-cautery knife should be heated to a bright red heat, and should then be pressed into the tissue of the tonsil by entering one of the crypts and cutting with it from within outward, so that the eschar resulting from the burn can easily fall off and does not become impacted in the tissue of the tonsil. This procedure does not give rise to any pain, and should be repeated at intervals of a week

FIG. 62.

Fahnestock's tonsillotome.

FIG. 63.

Seiler's modification of Mathieu's tonsillotome.

or ten days, and from four to six applications usually sufficed to reduce the tonsils to a size compatible with health and the comfort of the patient. Under no circumstances should any operation for the removal or reduction of hypertrophied tonsils be undertaken while the organ is in a state of acute inflammation. In the case of the ragged tonsil, scraping the tonsillar tissue from the capsule with a sharp curette has been recommended, but this method is not only very bloody, but also painful, and on that account the galvano-cautery is to be preferred.

For the removal of the scirrhous tonsil, the Jarvis snare is the best and safest instrument. The steel wire loop should be laid around the enlarged tonsil, and by turning the screw should be gradually decreased in size until the portion encircled by the wire is cut off. If done slowly, the operation occasions very little pain, and time is given for the edges of the rigid vessels to become agglutinated, so that little or no hemorrhage results. The best way is to start the snaring process, and then let the patient turn the screw himself, trusting to him that it is not done too quickly; for the patient will tighten the loop until he feels the pain, and will then stop, to begin again when the pain has ceased. The time occupied in thus removing a scirrhous tonsil is from two to three hours. The wound occasioned by the ablation of the tonsils by either of these methods usually heals within a few days by granulation, so that, after the lapse of a week from the operation, the parts present a normal appearance. During this time the diet of the patient should be of the mildest kind; spices and alcoholic stimulants should

be avoided, and if the patient complains of great soreness, flaxseed poultices should be applied to the sides of the throat. Usually, however, no complaint is made of any soreness, except during the act of swallowing, and even that is greatly diminished by taking liquid food through a tube.

CHAPTER XIII.

DISEASES OF THE NASAL CAVITIES AND NASO-PHARYNX.

The diseases of the nasal cavities and naso-pharynx form a class of affections which are distinct from those of the larynx and pharynx, and this distinction is due chiefly to the anatomical arrangements of the parts, as well as to the physiological function of the organs, which have already been described in detail (see Chapters III. and IV.), and we can, therefore, at once enter upon the consideration of the pathology and the diseases of the nasal and naso-pharyngeal cavities.

Pathology.—Most of the diseases of the nasal cavities are due to inflammatory processes, and but very few are due to traumatic injuries inflicted, either from the outside by blows, falls, etc., or on the inside by foreign bodies and the instrumental interferences instituted to remove them; they may be due to tumors or neoplasms growing within the nasal or pharyngeal cavities.

If we closely observe the course of a case of

simple acute coryza, we will find that the first symptom is a feeling of fulness, accompanied by sneezing, and that this usually occurs in one nostril at first, the other one being affected later in the same manner. An inspection of the mucous membrane shows it to be in a state of congestion, and so much swollen in certain portions, especially on the inferior turbinated bone, as to touch that of the septum. This produces partial stenosis of the nasal cavity, and is felt as fulness. The congestion having continued for some time, a watery discharge makes its appearance, which is produced by a hyperstimulation of the serous glands, and is increased by exudation of serum from the venous sinuses of the turbinated tissue. According to Cornil and Ranvier, lymph corpuscles are found in this watery discharge of the early stage of acute coryza, while other and later observers have found various bacteria. Later, the discharge becomes thicker by the admixture of the secretion of the mucous glands and of epithelial cells which have undergone fatty degeneration, and are thrown off by the rapid formation of new cells under the stimulus of the increased blood-supply. The mucous membrane, as well as the submucous and cavernous connective tissue, becomes infiltrated with numerous leucocytes, and the venous sinuses become distended.

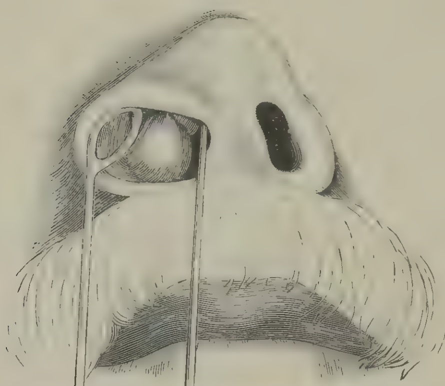
As the acute inflammation subsides, these conditions gradually disappear, leaving, however, the stretched mucous membrane thrown into folds as it contracts, which are especially noticeable at the posterior extremity of the inferior turbinated bone. While spreading, the inflammation involves the

glandular tissue situated in the vault of the pharynx, the so-called adenoid tissue or pharyngeal tonsil, and excites it to hypersecretion of the thick yellowish mucus which is expectorated toward the end of the attack. The mucous membrane lining the accessory cavities may also participate in the general inflammation, and the accumulation of secretion within them, produced by the obstruction of the narrow outlets by tumefaction of the cavernous tissue, causes an acute pain over the seat of the accessory cavity involved in the inflammatory process. Thus, if the antrum is involved, the pain is felt on the cheek, while if the frontal sinuses are the seat of inflammation, the pain is mostly felt over the eyebrows. Such involvement of the accessory cavity is, however, very rarely met with. The dull pain in the head, usually present, is occasioned by pressure of the engorged turbinated tissue, and is reflex in its nature.

Frequent repetitions of acute coryza at short intervals must of necessity produce a permanency of the inflammatory infiltration in the mucous membrane and submucous tissue, which infiltration finally becomes organized so as to form connective tissue; at the same time the venous sinuses remain more or less distended, and the epithelium of the gland-ducts begins to proliferate. In this way permanent swellings of the mucous membrane in the nasal cavities are formed at the most pendent portions, viz., the lower edge of the inferior and sometimes of the middle turbinated bones; but they are also found on the septum. These swellings are called hypertrophies, and are divided, according to

their location, into anterior, middle, and posterior. The anterior hypertrophies (Fig. 64)—those which are

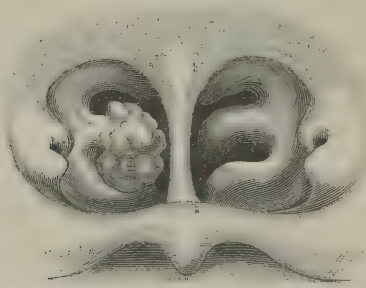
FIG 64.



Dilated nostril, showing anterior hypertrophy.

situated on the anterior extremity of the turbinated bones or on the cartilaginous septum—are usually

FIG. 65.

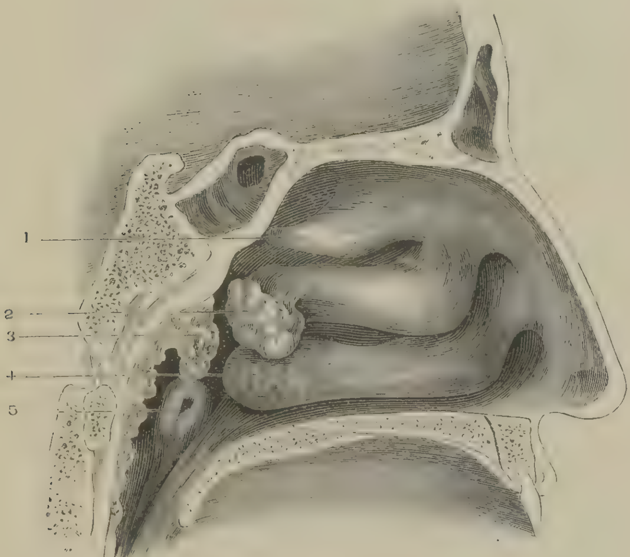


Rhinsocopic image from a case of posterior hypertrophy on the middle turbinated bone.

sessile and of a bright-red color, as are also the middle hypertrophies situated on the anterior portion of

the middle turbinated bone, while the posterior ones —occurring on the posterior extremity of the turbinated bones (Figs. 65 and 66)—usually have a short pedicle-like attachment and project into the vault of the pharynx. Their color is either a dark brownish-

FIG. 66.



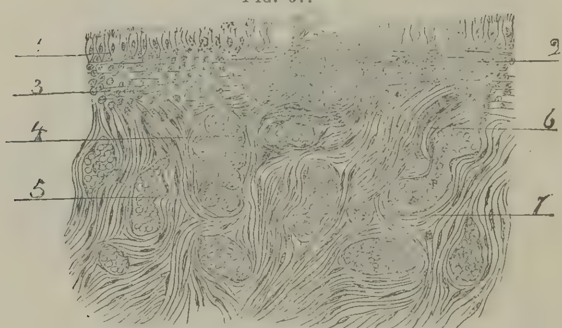
Vertical section through nasal cavities. (Diagrammatic.)

1. Superior turbinated bone. 2. Middle turbinated bone, with posterior hypertrophy. 3. Section of hypertrophied pharyngeal tonsil. 4. Inferior turbinated bone. 5. Orifice of Eustachian tube.

purple or a light yellowish-pink; and I find that those of a dark color are much softer than the light ones. Under the microscope a condition of the tissues in these swellings is noticed which has been already outlined.

Thus we see in a thin section of one of these hypertrophies that the epithelium is intact, although many of the cells, especially in the neighborhood of the openings of the glandular ducts, have undergone fatty degeneration. The basement membrane upon which the cells are mounted appears thickened, and immediately beneath it we find the mucosa densely infiltrated with a small-celled infiltration, so as almost entirely to obscure the mucous tissue. The gland-ducts are seen to be filled with proliferated epithelium, as are also the glands themselves. The

FIG. 67.



Section of posterior hypertrophy. × 250.

1. Epithelial layer. 2. Mucous follicle. 3. Submucosa, showing inflammatory infiltration. 4. Mucous glands. 5. Venous sinuses filled with blood. 6. Small branch of arteriole. 7. Transverse section of arteriole.

bands of fibrous tissue forming the caverns in the erectile tissue are much thicker than in the normal structure, and the venous sinuses are large and irregular in outline. Here and there we find the endothelial lining of these caverns proliferating. Scattered through the connective tissue are seen

numerous lymph-corpuscles. In some sections made from hypertrophies I have noticed myxomatous change taking place in the fibrous tissue. There is but a slight difference in structure between the anterior and posterior hypertrophies—viz., the venous sinuses in the anterior hypertrophies are not as numerous nor as large as in the posterior variety, and usually the inflammatory infiltration, as well as the new-formed connective tissue, is much more extended: so that we notice the venous sinuses only near the periosteum when situated on the turbinated bones, and close to the perichondrium when the swelling springs from the cartilaginous portion of the septum.

Thierfelder describes and figures the microscopic appearance of a nasal hypertrophy found by accident in a subject dead from mitral insufficiency, and to the heart-lesion he ascribes the formation of the swelling in the nose. There is, however, no doubt that these swellings are of inflammatory origin, and that in Thierfelder's case it coexisted with, but was not directly caused by, the heart-trouble, as he supposes. The erectile character of the tissue composing the hypertrophies causes them to increase in bulk under certain circumstances. Thus, I have noticed that they are larger in women during the menstrual periods, and probably during the first months of pregnancy. Alcoholic stimulants cause them to swell up, as does mental and sexual excitement; in fact, anything which tends to increase the blood-pressure in the head. In some cases they are larger in damp weather, while the moisture in the atmosphere does not affect them in others. It is probable that in the

first instance they have undergone myxomatous degeneration, giving them hygroscopic properties.

The glandular tissue situated in the vault of the pharynx, and known as the adenoid tissue or pharyngeal tonsil, also becomes involved in the general chronic inflammation, and is likely to become permanently hypertrophied. When thus enlarged, this tissue presents a rugged appearance in the rhinoscopic mirror, with rounded eminences projecting into the pharyngeal cavity. The secretion of this gland, when thus hypertrophied, is a thick, glairy mucus, which tightly adheres to the wall of the pharynx. Detached pieces of the tissue, when examined under the microscope, show the glandular elements greatly increased in number, the epithelium in the glands and ducts proliferating, and the scant connective tissue infiltrated with small-celled infiltration. This condition, however, but rarely interferes with the functions of the nasal cavities, except that it imparts to the voice a nasal sound by decreasing the size of the post-nasal cavity, and thus interferes with the normal nasal resonance. An enlargement of the turbinated bones themselves is sometimes met with, causing obstruction of the nasal chambers, simulating ordinary hypertrophy of the erectile tissue when viewed through the nasal speculum. Touching them with the probe, however, at once makes their bony nature evident to the observer. The middle turbinated bone is usually the one thus affected, and not infrequently we notice a splitting or cleavage, causing the under portion to be pressed against the septum, giving rise to various reflex symptoms. Woakes states that this cleavage

is always accompanied by necrosis of the interior of the bone, and by the formation of granulations on its surface. He also asserts that this condition gives rise to the formation of mucoid polypi.

On the lower portion of the cartilaginous septum we frequently notice protuberances which to the eye closely resemble the sessile hypertrophies of the mucous membrane, but which, when touched with a probe, have a hard, elastic feel, the same as is conveyed to the hand when touching the cartilaginous septum in other apparently normal portions. These are not localized deviations of the septum, for we do not find a corresponding depression on the other side, but they are true hypertrophies of the cartilage, as I had occasion to prove by removing a very large one, and submitting it to microscopical examination. The ecchondroses, as they are called, are of various shapes and sizes, sometimes presenting a tit-like projection from the smooth surface of the septum; sometimes they are ridges running horizontally, vertically, or obliquely from before backward, or from below upward; and, in not a few cases, we notice them as shelf-like projections running along the lower portions of the septum, leaving but a narrow channel between their lower surface and the floor of the nose, and they often extend along the whole length of the septum. In most instances ossification in their substance has taken place. As regards their origin, I have come to the conclusion that these simple cartilaginous excrescences are due, not to external traumatism, but to internal local irritation of the mucous membrane of the cartilaginous septum primarily, and of the perichondrium second-

arily. If we consider that a turgescent or hypertrophied portion of the turbinated tissue, which for a considerable length of time is in contact with the mucous membrane of the septum, must necessarily exert a certain amount of pressure upon that mucous membrane, and upon the perichondrium underlying it, and that even a very slight pressure, when it is kept up for a considerable period of time, will produce local congestion of the part pressed upon, be it on the outer integument of the body or the mucous membrane, it seems plausible to assume that this local congestion gives rise to changes of nutrition of the part sustaining the pressure. Taking into consideration the peculiar histological structure of cartilage, and particularly of hyaline cartilage, in which the blood is supplied by loops of vessels dipping into the substance of the cartilage from the perichondrium, and the nutrition of the cells is carried on by osmosis from one to the other without the intervention of a capillary network of bloodvessels, we can readily see that a localized increase of blood-supply to these loops must necessarily give rise to a *more* rapid cell-division and proliferation of the intervening cartilage-cells than is demanded to supply the waste by cell-death, and localized increase of cartilage-tissue must result therefrom.

In the majority of cases the cartilaginous projections from the surface of the septum correspond in position and size to the line of pressure by the turbinated tissue, and in those cases of atrophic rhinitis in which they are found, careful examination of the patient will elicit the fact that at some former period a hypertrophic rhinitis has existed, which has given

rise to the ecchondroses in the manner described. It is, of course, impossible to state what length of time is required for their formation, and how long the pressure must exert its influence before any elevation on the surface of the septum becomes apparent. And, further, it is impossible to give any reason why, in some instances, no apparent redundancy of tissue results from long-continued pressure by the turgescent turbinated tissue. Individual peculiarities in this case, as in many other pathological formations in the body, must account for the differences noted in different cases. In some instances an excessive growth of an ecchondrosis from the septum will cause it to press against the opposite turbinated bone, when erosion of both surfaces takes place, and a bony union between the septum and the turbinated bone is established, forming a more or less extensive bridge across the nasal chamber. In one case which has come under my observation, the whole length of the septum was thus united with the lower turbinated bone, causing complete stenosis of the affected nasal chamber. Gottstein holds a similar view as to the causation of these ecchondroses, while Bosworth claims that they are invariably of traumatic origin.

On the floor of the nose we frequently see bony excrescences springing from the superior maxillary bone, which were described by Dr. Harrison Allen. These are usually congenital, and, unless they give rise to pain and inconvenience by pressure through their size, are harmless.

In many cases, deviation of the cartilaginous septum is due to an inflammatory process of long

duration, and beginning early in childhood. The thin cartilaginous plate being over-nourished by the continually congested perichondrium, has deposited within its substance more new cells than are required to substitute the old and defunct ones which are being carried off, and consequently increases in bulk. But the bony framework into which it is set prevents an extension in height, and consequently a bulge to one side or the other occurs, just as a card being held edgewise between the thumb and forefinger will bulge when pressed.

Malformations in the bony walls of the nasal cavities are by no means rare, and the most common one is deviation of the bony septum. This is so frequent that Semeleder found the septum straight in only ten out of forty-nine skulls examined, and Allen found the nasal chambers normal in eighteen out of fifty-eight adult skulls examined. This deviation of the septum must in a great measure be attributed to the fact that at birth both the vertical plate of the ethmoid bone and the cribriform plate are not as yet ossified, and do not become rigid until a much later period of life, and may therefore be easily distorted by external violence applied to the nose by blows or falls. The act of blowing and wiping the nose with the handkerchief must also be considered as a factor in the production of deviation of both the bony and cartilaginous septum.

Hypertrophy or expansion of one of the turbinated bones also is not unfrequently a cause of deviation of the septum, which is crowded out of its normal position by the protrusion from the lateral wall of the nasal cavity.

This short description of the pathological conditions will, I trust, be sufficient to give an insight into the nature of the morbid processes observed in diseases of the nasal cavities; and we will, therefore, at once enter upon the consideration of these diseases.

Coryza.

An acute inflammation of the nasal cavities which is called *coryza*, or cold in the head, exhibits the well-known symptoms of, first, a feeling of fulness in the nose, which gradually ascends into the forehead, producing there a dull frontal headache. In individuals who have very thick and long hairs growing in the vestibule, an intolerable tickling of the skin of the vestibule frequently precedes these symptoms, which is caused by a change in the position of these hairs, so that the ends tickle the opposite wall of the nostril, this erection being due to a congestion of the hair-follicles.

An irritation of the mucous membrane next shows itself, by frequent sneezing and tumefaction causing partial, or complete, stenosis accompanied by a burning sensation in the nose, and finally a copious watery discharge, which later on becomes thicker by the admixture of mucus, makes its appearance.

Constitutional disturbances show themselves by general languor and slight febrile symptoms, more or less pronounced in different individuals, and varying with the severity of the local inflammation.

On inspection of the anterior as well as the posterior nasal cavities, which, however, is rarely made except for the sake of study, the mucous membrane will be

found to be swollen and intensely red, the swelling frequently obliterating the convolutions of the turbinated bones. Abrasions or ulcerations are entirely absent in a simple coryza.

Cause.—This affection is caused either by a sudden chilling of the surface of the body or by local irritation of the mucous membrane through the inhalation of acrid vapors, or particles of dust, etc. Among the former, *osmic acid* is peculiarly rapid in its action, producing an active coryza in from one to two hours after exposure to its acrid fumes.

The duration of the affection is, as every one knows, a few days. It generally disappears within nine days from the advent of the first symptoms.

Treatment.—In regard to the treatment of this affection very little is to be said, inasmuch as every one agrees that nothing can be done to shorten or stop the symptoms when once fully established, and, therefore, the disease is usually left to run its course. If, however, the irritation becomes so great that the patient is compelled to sneeze incessantly, protection of the irritable mucous membrane from the air is very grateful to him. This may be accomplished by a snuff composed of gum acacia, subnitrate of bismuth, bicarbonate of sodium, and a little sulphate of morphia. The gum arabic coming in contact with moisture forms a paste, which is made still more protecting to the mucous membrane by the bismuth, when introduced into the nostrils as a snuff. The soda is added to prevent acid fermentation, and the morphia to lessen the sensibility.

Bromide of potassium, given in doses of from fifteen to twenty grains every three or four hours,

hastens resolution somewhat in a great number of cases, while in others it seems to have no effect. The fumigation of the mucous membrane by muriate of ammonium vapor from the inhaler described in Chapter III., and also by vapors of volatile substances, such as balsam of tolu, tincture of benzoin, carbolic acid, etc., frequently hastens resolution and reduces the irritation, thus making the patient more comfortable. The instillation of a four per cent. solution of cocaine into the nostrils also gives great relief by the contraction of the turgescent turbinated tissue. It should, however, not be used more than two or three times a day, as it loses its effect and increases the tumefaction of the tissue when the reaction sets in. Washing out the nasal cavities with the author's antiseptic solution (see Chapter VI.), by means of an atomizer, or even by sniffing it up the nose, is very grateful.

Abortive treatment is, however, often successful if commenced in time. The remedies employed to cut short a cold in the head are, inhalation or rather fumigation with iodine in the form of the tincture, which must be used directly after the exposure to the cause, hot stimulating drinks, such as hot whiskey punch, a remedy which is used in every household to avert a cold of any kind. Its action is supposed to consist in an equalization of the disturbed capillary circulation on the surface of the body. In doing this it prevents a local congestion and inflammation. Tr. of aconite rad. in small doses, often repeated, also frequently aborts an attack of acute coryza. If, however, the congestion has already set in, alcoholic stimulants will aggravate it. But even then a cold

in the head can be aborted in many cases by the use of the nasal douche, when obstruction of the anterior nasal chambers does not as yet exist, using the water at a temperature a little above blood-heat, and adding to it some astringent together with common table-salt.

Nasal Douche.—As the nasal douche is constantly employed in the treatment of acute and chronic inflammations of the lining membrane of the nasal cavities, I will here say a few words in regard to the proper use of this instrument.

The nasal douche (Fig. 68) is a vessel either of glass or tin, holding from one-half pint to two pints

Fig. 68.

Thudichum's nasal douche.

of liquid, and having near its bottom an opening. This opening is in connection with a rubber tube fitted at the free end with a nozzle of glass, rubber, or wood, and fashioned so as to fit the nostril. The vessel being filled, and the nozzle introduced into one of the nostrils of the patient, the water by gravitation runs up the one side of the nose until it reaches the posterior surface of the velum palati closing the

nasal cavity behind, and runs out by the other nostril, thus bathing the mucous membrane, and cleansing it by removing all hardened mucus, either directly or by loosening it so that it can be removed afterward by blowing the nose.

There are, however, certain precautions necessary in using the nasal douche, which, if disregarded, lead to very unpleasant results, and there are a few cases in which a fatal inflammation of the brain has been attributed solely to the use of this instrument. Dr. Roosa, of New York, as well as Dr. Lenox Browne, of London, record cases of severe inflammation of the middle ear, caused by the nasal douche, and they consequently condemn this instrument as dangerous and of little use. On the other hand, Dr. L. Elsberg, of New York, and many others, among them the author, have never met with a case of injury resulting from the use of this instrument, where the precautions to be mentioned had been observed by the patient. Dr. Browne does not seem to lay much stress upon the proper density and temperature of the liquid, and this may be the cause of the unpleasant symptoms he observed in many cases following the use of the nasal douche. If, however, the precautions are closely observed, not only will there be no unpleasant effects following the use of the instrument, but, on the contrary, the patient being pleased with its action is not willing to do without it.

Precautions in the Use of the Nasal Douche.—In the first place, the bottom of the vessel should, under no circumstances, be elevated more than an inch or so above the eyebrows of the patient, as otherwise the pressure is so great as to force the water into the

frontal sinuses or into the Eustachian tubes, giving rise in the first instance to intense frontal headache, and, in the second, to an inflammation of the mucous membrane of the middle ear.

The temperature of the liquid should be raised in the vessel to slightly above blood-heat, so that after it has run through the tube, and has thereby lost some of its heat, it will feel neither hot nor cold to the parts.

Furthermore, the liquid used should be of the same density or specific gravity as the serum of the blood. The congested capillaries and venous sinuses being near the surface of the mucous membrane, while the liquid is on the other side, only a thin wall of epithelial cells separates them, and thus the most favorable conditions for osmosis are presented. If the liquid used in the nasal douche be of a greater specific gravity than the serum of the blood, exosmosis of the latter will take place, leaving the corpuscles more densely crowded in the capillaries, thus clogging them, and producing an irritation of the sensory nerve filaments, which we perceive as a burning pain. If, on the other hand, the liquid is of less density than the serum of the blood, endosmosis will occur, and the capillaries will be distended with the increase of liquid, which again causes pain by excitation of the nerve filaments. It becomes, therefore, necessary to use in the nasal douche a liquid which is like the serum of the blood in density as well as in temperature. Such a liquid may be obtained by mixing about fifty-six grains of salt with a pint of water. Dr. J. G. Richardson, while engaged in his investigations on blood-stains, found that a

solution of fifty-six grains of salt in a pint of water produced a liquid in which blood corpuscles became neither crenated nor swollen, as they do when suspended either in a heavier or lighter liquid than serum, and he consequently used such a liquid with very satisfactory results. For practical purposes it is, however, sufficient to make the liquid to be used in the nasal douche, by adding an *even* teaspoonful of salt to a pint of water at 100° F. To this may be added any astringent, stimulating, or disinfecting solution, provided the chloride of sodium does not produce a chemical change therein, as would be the case with nitrate of silver, and provided also that the specific gravity of the liquid be not materially changed by the addition of such other substances.

More important, however, than the above precautions is the proper selection of cases. If, as is so frequently the case in nasal catarrh, the nostrils are more or less obstructed by deviation of the septum, exostosis or *ecchondrosis* of the septum, or by anterior or posterior hypertrophies of the erectile tissue covering the turbinated bones, and by polypi, the easy outflow of the fluid is prevented, it accumulates in the post-nasal cavity, and is forced into the middle ear, the frontal sinuses, and even into the antrum and ethmoid cells, giving rise to inflammation of the mucous membrane lining these cavities. It frequently occurs that the hypertrophies act as valves, allowing the fluid to pass up, but prevent it from flowing out again. This is especially noticeable in cases of posterior hypertrophies, which, being attached to the turbinated bones by a sort of pedicle, are forced by the inflowing current into the post-

nasal cavity, thus making room for the liquid to pass in, but are tightly wedged into the posterior opening of the nasal chamber by the return current, and prevent any outflow.

In cases where the tissue is not sufficiently hypertrophied to cause an obstruction to the current of liquid from the nasal douche under ordinary conditions, it will swell up and cause obstruction when an acute congestion is present, or if the fluid used is too cold or not of the proper density. The same objections hold good when the post-nasal syringe or douche is used, for an obstruction in the nostrils also causes in this case an accumulation of liquid in the post-nasal cavity.

It will, therefore, be seen that the nasal douche should be used only in those cases of nasal disease in which there is no obstruction in the nasal chamber; but where there is an accumulation of secretion which, becoming inspissated, gives rise to the fetid odor noticed in ozæna, a copious stream, such as can only be obtained from the anterior or posterior nasal douche, is needed to remove the dried crusts and thoroughly cleanse the nasal cavities, and I am in the habit of adding some soda or borax to the solution of salt and water, because I have found that an alkaline solution dissolves and dislodges the crusts more readily than a neutral one. The amount of salt should, of course, be reduced in proportion to the addition of the alkali.

In cases of complete or partial stenosis of the nasal chambers, it is better to let the patient "sniff" the salt or alkaline solution up into the nose from the hollow of the hand, or to use a hand-spray to

cleanse the nasal cavities. The Dobell's, or the author's antiseptic solution, is better adapted to these cases than the plain salt and water.

Several forms of the nasal douche are in the market, some of which have great disadvantages, and are therefore to be avoided: for instance, the bottle form, which is most generally sold (Fig. 68). The narrow mouth of the bottle makes it inconvenient to introduce the salt, and impossible to use a thermometer to test the temperature, while it also prevents a thorough cleansing of the vessel. The glass tube at its bottom to which the rubber tube is attached is easily broken off, and then the instrument is useless. Furthermore, it is too expensive an apparatus for the use of the poorer class of patients.

Fig. 69.

Siphon nasal douche.

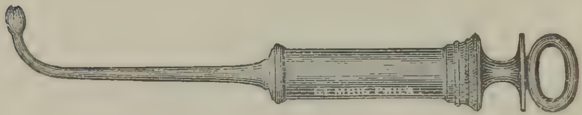
Another form, called the pocket or siphon nasal douche (Fig. 69), is very convenient, and efficient in the hands of an intelligent patient, but almost useless in the majority of cases, inasmuch as it is nothing but a siphon, which must be started in order to work. It consists of a rubber tube with a nozzle at one end and a weight attached to the other. The weighted end is sunk into the vessel containing the salt solu-

tion, which is elevated to the proper height; the air is then sucked out of the tube and the current thus started. In using this siphon-tube it is always necessary to keep the free end a little below the level of the weighted end.

The form of nasal douche which will be found most satisfactory, durable, and at the same time inexpensive, consists of a pint tin cup, with a piece of tin tube soldered in a hole cut near the bottom of the cup, to which the rubber tube is attached. The nozzle at the free end of the tube is made of hard wood soaked in paraffine, or of horn. This form of douch cannot be broken, is easily kept clean, the temperature can be accurately measured, and it costs so little that even the poorest patients can afford to use it.

Before the introduction of the nasal douche by Prof. Thudichum, a syringe made of rubber, with a curved nozzle, called the *post-nasal syringe* (Fig. 70),

Fig. 70.



The post-nasal syringe.

was used for the introduction of medicated solutions into the post-nasal cavity, and this instrument is frequently of great advantage at the present day in cases where strong astringent and stimulating solutions are to be employed, or in cases where the crusts of hardened mucus fail to become loosened and washed away by the gentle stream of the nasal

douche. In the latter cases the nozzle of a syringe should have a slit-like opening instead of the usual five or six small holes, because greater force is necessary to dislodge the crusts.

The introduction of the post-nasal syringe is, however, somewhat difficult, inasmuch as the nozzle has to be brought up behind the soft palate, and it should, therefore, not be trusted to the patients, although they often do learn to use it on themselves. After the nozzle has been brought up behind the soft palate, the patient is directed to keep his mouth open and bend his head over a basin, so that the stream of liquid shall pass out of both nostrils and not regurgitate back into the mouth.

We are now prepared to return to the consideration of the diseases of the nasal cavities, and will take up the chronic forms of simple rhinitis, commonly called chronic nasal catarrh.

CHAPTER XIV.

CHRONIC NASAL CATARRH.

A CHRONIC inflammation and consequent derangement of the normal conditions of the nasal and naso-phyryngeal cavities, no matter what the cause may be, is designated as chronic nasal catarrh, and, although the term catarrh is not strictly correct as applied to this group of affections, yet it is universally used, and we will, therefore, adhere to it.

Nasal catarrh is one of the most frequent affections in this country, so much so that it has been estimated that out of one million inhabitants of the United States, nine hundred and ninety thousand suffer therefrom, and this average is even greater in some localities. This very frequency of the affection has probably given rise to the popular belief, which is shared to a great extent by the profession, that nasal catarrh is incurable. Yet if we intelligently examine into the pathological conditions giving rise to the symptoms we will find that, in the majority of cases, we can reasonably hope to restore the healthy condition of the mucous membrane by rational treatment, and so cure our patients, often in a comparatively short time.

Simple Chronic Catarrh.

By this term is meant a chronic catarrhal inflammation of the nasal mucous membrane, not dependent upon any systemic dyscrasia, such as scrofula, syphilis, lupus, etc., but altogether a local disease, which, however, as has already been mentioned, may give rise to systemic disturbances.

This affection is conveniently divided into two large subdivisions, viz., into hypertrophic and atrophic nasal catarrh, which may arise independently from each other, or the atrophic may be a sequel and consequence of the hypertrophic variety. As the treatment is, however, very different, these two varieties must be considered under separate heads.

Hypertrophic Catarrh.—In this variety of the affection we observe two stages, viz., the stage of conges-

tion with turgescence of the venous sinuses in the turbinated cavernous tissue, producing temporary obstruction; and the later stage of true hypertrophy of the cavernous tissue as well as of the mucous membrane, producing permanent occlusion.

The symptoms of the first stage are usually a superabundant watery discharge from the nostrils, which becomes greater when the patient is exposed to cold; a partial occlusion of either one, or the other, or both nostrils, which is transient in character and appears rather suddenly, when the mucous membrane is irritated by dust or by cold air, as well as from any cause which will produce an increased blood pressure in the head, such as alcoholic stimulants, emotional disturbances, etc.; a frequent recurrence of an acute coryza from trifling exposures, which, however, is not as severe nor as long continued as true acute coryza, in some cases lasting for a few hours only; and finally a slight impairment of nasal resonance. There may or may not be a discharge of thick glairy mucus from the glandular tissue of the vault of the pharynx, according to the amount of congestion or inflammation present in that region. Pharyngeal and laryngeal symptoms are usually not prominent, although a congestion of the mucous membrane of the larynx is observed in the laryngeal mirror, and a more or less diffuse inflammation of the pharyngeal mucous membrane, with enlargement of the follicles, is noticed on examination of these structures (Plate II., Fig. 3.)

On inspection of the nostrils we see the mucous membrane to be red, and somewhat swollen and spongy to the touch of the probe, the cavernous

tissue covering the turbinated bones, especially the lower ones, is bulged out, thus diminishing the calibre of the cavities, but by gentle pressure upon it with a flat probe, or by the action of a weak solution (four per cent.) of cocaine, it can be reduced to its normal size, and the same effect is produced by a moderately strong, constant galvanic current, five or six milliampères, if the positive pole is placed on the nape of the neck and the negative on the side of the nose over the affected nostril. Sometimes the one and sometimes the other nostril feels slightly obstructed, and when the patient is placed in a recumbent position it is the side on which he lies which feels full, to become open, frequently with a sort of click, when he turns over on the other side, which, then, in turn, becomes obstructed. A rhinoscopic examination, which is usually somewhat difficult to make on account of the increased sensitiveness of the upper pharynx probably due to the congestion of the parts, reveals the same condition of the mucous membrane in the vault of the pharynx as was noticed in the nostrils, while the cavernous tissue over the posterior portions of the turbinated bones, if not enlarged at the time, is usually "puckered." The tissue around the openings of the Eustachian tubes may or may not be swollen, and the pharyngeal tonsil is somewhat more prominent than normal.

On account of the slight inconvenience experienced by the patient, we but seldom have the opportunity to see nasal catarrh in this stage, unless we examine every case of laryngeal or pharyngeal disease which comes under our notice, for this trouble.

This condition may last for years unchanged, or it may pass into the second stage within a few weeks or months.

The second stage, on the other hand, is the stage of catarrh most frequently met with, and presents the following symptoms. The patient complains that his nose feels stopped up, especially when he assumes the recumbent position; that during the night his mouth and throat feel dry; in the morning and at frequent intervals during the day, he has to "hawk" in order to relieve a feeling of fulness caused by the accumulation of a thick, tenacious, and more or less discolored mucus in the vault of the pharynx. Ordinarily the nostrils feel dry, but a slimy discharge appears when the mucous membrane is irritated. In many cases, a dull frontal, or, in some cases, a basilar, headache is present, which at times, after an exposure to a cold and damp, or dusty atmosphere, assumes the character of neuralgia. Spontaneous bleeding of the nose is also a frequent occurrence in this condition, and when it occurs the headache usually is diminished, or disappears altogether. Based upon this observation, Dr. Glasgow, of St. Louis, treats congestive headaches by incisions into the congested turbinated tissue, a procedure which gives, in many cases, almost instant relief. The nasal resonance of the voice is materially impaired, causing what is termed a "nasal twang." More or less dryness of the pharynx, with follicular enlargement in the mucous membrane, and a dry, tickling, laryngeal cough are present in cases of long standing. Asthma is also frequently found to be dependent upon the nasal obstruction, but it is more

particularly noticed when the obstruction is produced by nasal polypi; while many other remote symptoms, called reflex, such as paresis of the palate, paralytic dysphagia, paralysis of the vocal cords, excessive lachrymation, paroxysmal sneezing, spasmodic cough, and many other like reflex symptoms are found to be due to intra-nasal disease, and particularly to pressure by obstructions. The sense of smell, although not lost, is considerably blunted, and as a consequence the sense of taste also is less acute, so that patients suffering from this affection require more and more seasoning in their food as the disease progresses. There may be a bad odor perceptible to the patient as well as to others, but this is not usually the case; and if present, it is different in character and less pronounced than the odor met with so frequently in atrophic nasal catarrh.

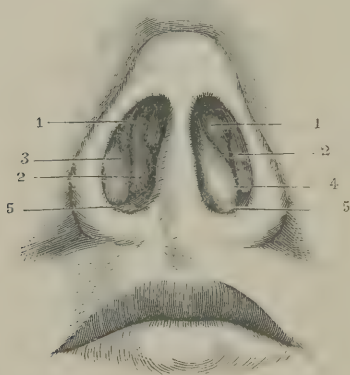
In many cases a chronic middle ear catarrh is present, accompanied by impaired hearing, and more or less tinnitus, which is caused by closure of the Eustachian tube by mucus or by hypertrophy of the tissue around the opening. In the same manner do we find, in some cases, a catarrhal conjunctivitis which is dependent upon the nasal trouble, and is probably due to extension of the inflammation through, and to compression of the nasal opening of the lachrymal duct by the hypertrophies, or it may be due to reflex irritation of the ophthalmic branch causing this sympathetic inflammation. In almost all cases a broadening of the bridge of the nose, and a thickening of the outer integuments of the organ are very noticeable, giving rise, in some instances, to compression of the venous trunks and consequent

stasis in the capillaries of the skin, which shows itself as redness of the skin, almost identical in appearance with the red nose of persons addicted to too frequent use of alcoholic stimulants. Acne rosacea, as well as acne punctata are frequently met with in cases of hypertrophic as well as atrophic nasal catarrh, and this irritation of the skin of the face is due, no doubt, to two causes, viz., first, reflex irritation of the vaso-motor nerves of the skin, and, second, to the inability of the erectile tissue of the nose to act as a safety-valve in relieving the surplus blood pressure in the capillaries of the skin of the face and nose. These conditions often are so prominent as to amount to deformity, and it is highly gratifying to the patient to see them gradually disappear, as the mucous membrane in the nose assumes its normal condition under appropriate treatment.

On inspection of the anterior nasal cavities, which should always be made with the *nasal speculum*, so as to prevent stretching of the ala, and consequent disturbance of the relation of the parts to each other, we find the mucous membrane of a light-red color, darker than normal, but lighter than in either acute coryza or in the first stage of the disease. It, as well as the underlying cavernous tissue over the turbinated bones, is thickened, so as to bulge out into the nasal chamber, more or less occluding the open space; especially is this noticeable at the lower portions of the turbinated bones (see Fig. 64). These hypertrophies, as they are called, whose anatomical nature was described in the preceding chapter, when pressed upon with the probe cannot be reduced but only indented, which depression imme-

diately disappears on the withdrawal of the probe, while cocaine solutions reduce their bulk but very little. In some cases we find not only the soft tissues but also the turbinated bone itself hypertrophied, or expanded beyond its normal size, which can readily be demonstrated by the touch of the probe. When the hypertrophies are so large as to press against the septum, we frequently notice shallow ulcers of the mucous membrane covering the septum at the point of contact, and spreading from thence over a larger area. These hypertrophies when situated at the anterior portion of the

FIG. 71.



Dilated nostrils, showing ecchondrosis of septum.

1 1. Middle turbinated bone. 2 2. Lower turbinated bone. 3. Edge of vestibule. 4. Shelf-like projection from septum. 5 5. Floor of nose.

lower turbinated bone are termed "anterior hypertrophies;" when on the middle turbinated bone, as seen from the opening of the nostril, they are known as "middle hypertrophies."

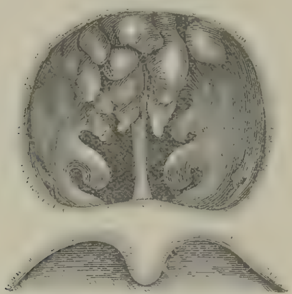
In cases of long standing we find thickening of the cartilaginous portion of the septum, and exostosis of the vomer, which not unfrequently is localized, and assumes a shelf-like shape (Fig. 71), running the whole length of the septum, the flat surface of the shelf being below and near the floor of the nose, and leaving but a small portion of the inferior meatus pervious. In other cases, as already mentioned, we find ecchondroses from the cartilaginous portion of the septum, which may be in the shape of rounded eminences or ridges running in various directions.

Deviation of the septum and bony excrescences into the floor of the nose from the superior maxillary bone, are also sometimes found to produce obstruction of the anterior nasal chambers; their pathology and causation have already been mentioned.

A rhinoscopic examination, which usually presents no difficulty in these cases on account of a certain amount of sluggishness of the velum, shows the mucous membrane in the vault of the pharynx and at the posterior nares to be in the same state of inflammation that was noticed in the anterior nasal chambers. If the nose has not been washed out previous to the examination, flakes of thick white mucus will be seen adhering to the mucous membrane, and especially in the depression around the opening of the Eustachian tubes, as well as in the crypts of the pharyngeal tonsil, which latter is more or less enlarged. In some cases the enlargement or hypertrophy of this glandular tissue amounts almost to a new growth, and may, besides causing an ob-

struction to the air-current, prevent the posterior nares from being seen in the rhinoscopic mirror (Fig. 72). In other cases the cavernous tissue

Fig. 72.



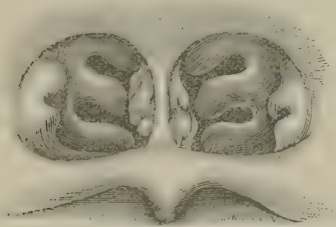
Rhinoscopic image in case of hypertrophy of pharyngeal tonsil.

covering the posterior extremities of the lower and middle turbinated bones is seen to be hypertrophied, forming tumor-like excrescences, which hang by a short thick pedicle in the nasal cavity, thus producing stenosis (Figs. 65 and 66). These posterior hypertrophies are of two varieties, viz.: the kind which appears of a white color, with a deeply notched surface and of a tough, fibrous consistence, and the kind which has a purplish-brown color, with a smoother surface and much softer than the other variety. This latter kind frequently bleeds, and as the flow of blood is prevented from entering the anterior nasal chambers by the obstruction produced by the hypertrophy itself, it runs down the pharynx, and on entering the larynx gives rise to cough, thus simulating hæmoptysis.

In other cases, still, we notice protuberances on one side, or on both, of the vomer, usually of a

lighter color than the rest of the mucous membrane (Fig. 73), which may be the posterior extremities of the shelf-like projections from the septum, or may be exostoses from the vomer, or, finally, more fre-

FIG. 73.



Rhinoscopic image in a case of hypertrophic tissue on the vomer.

quently are hypertrophies of the mucous membrane and its underlying tissue. Ulcerations are but rarely seen in the post-nasal cavity in this form of chronic nasal catarrh.

Causes.—The causes of chronic nasal catarrh are very numerous, and it is difficult to name any one in particular; but most of them are intimately connected with the pleasures and vices of civilized life, for this disease is not found among the lower animals, and but seldom among the uncivilized races of man. As has been said, a frequent repetition at short intervals of an acute coryza, which sequence often happens in our changeable climate, predisposes the mucous membrane to chronic inflammation, and thus weakening the tone of the muscular fibres surrounding the sinuses of the cavernous tissue, causes them to become distended and form the hypertrophies.

The breathing of impure air in ill-ventilated rooms, and especially at night and during sleep, is

a frequent cause. So, also, is inhalation of air filled with dust, and particularly dust composed of filaments of cotton or wool, such as is to be found in cotton mills, and in rooms the floors of which are covered with carpet. This is probably the reason why this disease is so much more prevalent in America and England than on the continent of Europe, where carpets are only to be found in the houses of the wealthy. Alcoholism, masturbation, venereal excesses, and anything that tends to lower the vitality of the system must be looked upon as causes of nasal catarrh.

Partial or complete stenosis, produced by the introduction of foreign bodies into the nostrils, by congenital or acquired malformation of the bony framework of the nose, or by neoplasms of any kind, or, finally, by the calcareous deposit around a nucleus of foreign matter called a rhinolith, which sometimes assumes such proportions as to produce complete stenosis of the nasal chamber, will cause chronic nasal catarrh. This is a point of great importance, for, as we have seen, nasal stenosis is produced by the catarrh itself, and is kept up by it. It would, therefore, be reasonable to suppose that, if the obstruction to nasal breathing is removed, the chronic inflammation will either disappear per *vis medicatrix naturæ*, or else will be cured by mild astringent applications in a short time. This is fully verified by clinical observation, and gives us the key-note to the successful treatment of hypertrophic nasal catarrh.

Treatment.—The treatment of hypertrophic nasal catarrh must be directed mainly to the locality in

which the disease manifests itself, viz., the mucous membrane of the nasal cavities, and must be calculated to restore that mucous membrane to its normal condition. Both in the first and second stage the nasal cavities must be kept free from the accumulations of mucus, by washing them twice daily, or oftener if necessary, with the normal salt solution (an even teaspoonful of salt to a pint of water), or with the author's antiseptic solution, which should be sniffed up the nose from the hollow of the hand. Astringent solutions thrown into the nostrils with the atomizer should be used by the practitioner only, two or three times a week, and he should select the particular astringent best suited for the individual case, such as a solution of ferric alum (four grains to the ounce of water) or weak solutions (five or ten grains to the ounce) of sulphate of zinc, copper, iron, etc.; distilled extract of witch-hazel, diluted one-half with water; or finally, Boulton's solution, of which the following is the formula:

℞.—	Tinct. iodini comp.	♏xx.
	Ac. carbol. (cryst.)	♏vj.
	Glycerinæ,	fl ℥ vij.
	Aq. dest.	fl ℥ v.

M. et place in water bath of 100°, in tightly corked bottle, until the solution becomes colorless; then filter and use in atomizer.

A moderately strong constant current of electricity (five or six cells), the positive pole to the neck and the negative over the nose, applied two or three times a week, for about five minutes at a time, has a very beneficial effect in reducing the turgescence of the venous sinuses in the first stage, but is of no

avail in reducing the permanent hypertrophies of the second stage.

In those cases in which there is dryness of the mucous membrane in the nostrils, and a thick, glairy, mucous discharge from the vault of the pharynx, the topical application of iodine to the post-nasal cavity is of great benefit in stimulating the serous glands and making the secretions more watery; besides, it has the effect of diminishing the hyper-sensitiveness of the palate, so that after a few applications a rhinoscopic view can be obtained, which before was impossible. The applications may be made through the mouth by means of a tuft of cotton soaked in the solution and held in the sponge-holder or cotton-applicator, bent to the right curve to reach the vault of the pharynx, or it may be made by passing the straight cotton-applicator through the nostril to the posterior nasal cavity along the lower meatus, which can always be done in the first stage, or even in the second where there are no bony or hard obstructions. The effect of the iodine upon the mucous membrane of the anterior nasal chambers is also very beneficial in reducing the inflammation and the sensitiveness, so that I am in the habit of making an application both to the naso-pharyngeal cavity through the mouth, and whenever possible also through the nostrils. When the application is made through the mouth, great care must be exercised to prevent the iodine from entering the larynx, by running down along the posterior wall of the pharynx, for if it does so severe laryngeal spasm almost invariably sets in.

Three solutions of the following strength will be found to answer in most cases:

No. 1.	℞.—Iodine,		grs. viij.
		Potass. iod.	grs. xxxviij.
		Glycerinæ,	fl ℥ vjss.
No. 2.	℞.—Iodine,		grs. xij.
		Potass. iod.	grs. lviij.
		Glycerinæ,	fl ℥ vjss.
No. 3.	℞.—Iodine,		grs. xv.
		Potass. iod.	grs. lxxv.
		Glycerinæ,	fl ℥ vjss.

Applications should be made with solution No. 1 until the patient ceases to feel any sensation a few minutes after. No. 2 should then be used; and when it has lost its power to irritate, No. 3 may be resorted to, but is not called for in the majority of cases. The smarting occasioned by the iodine solutions can be mitigated to a great extent by throwing a spray of fluid cosmoline (No. zero) into the nostrils, and follow this by blowing some of the morphia and bismuth powder recommended in the treatment of acute coryza.

Nitrate of silver in any form or strength, as well as astringents and irritants in the form of powder, *should under no circumstances be used in the treatment of hypertrophic nasal catarrh*, as they invariably give rise to swelling of the mucous membrane, and an increase in the hypertrophies, thereby aggravating the symptoms.

Muriate of ammonium in the form of vapor, and the smoke from burning cubebs, are popular remedies in this disease; but after careful trial, extended over a long period and with a number of patients, I found that the effect of these remedies, although pleasing at first and seemingly beneficial, is entirely

lost within a very short time, and it is therefore useless to try them The only good quality they possess is that they are harmless, and may be used as psychotherapeutical agents in acting upon the mind of the patient.

There are a number of drugs which, when taken internally, act upon the nasal mucous membrane, and thus aid the local applications in their curative action. Among them are the iodide of potassium in small doses, combined with bromide, the oleo-resin and the cold expressed fluid extract of cubebs, the fluid extract of Grindelia robusta, iodoform, crude petroleum, etc.

Tonics, fresh air, regulation of diet, and hygienic surroundings, as well as a change of occupation (if it is found to be the exciting cause of the trouble), should be as a matter of course advised, with a view to tone up the system and remove the exciting cause. In all cases the treatment must necessarily be a more or less protracted one, and it is of importance that the local applications be made at short intervals in the beginning at least. Under no circumstances should any surgical procedure be undertaken until all acute and subacute inflammation has been reduced by these topical applications and the general medical treatment.

Thus far we have considered only what might be termed the medicinal treatment of the disease, viz., the internal administration and the local application of remedial agents to the seat of the disorder, as well as attention to the general health of the patient, and it remains to describe the more important part of the treatment, especially as regards the second

stage of hypertrophic catarrh, viz., the removal of the stenosis, which may be termed the surgical treatment; for this can be accomplished only either with caustics or with cutting instruments.

Surgical treatment.—As the obstructions to the current of air in the nasal cavities vary in character, different methods must be employed for the removal of the different varieties, and this makes it necessary that they should be considered under different heads.

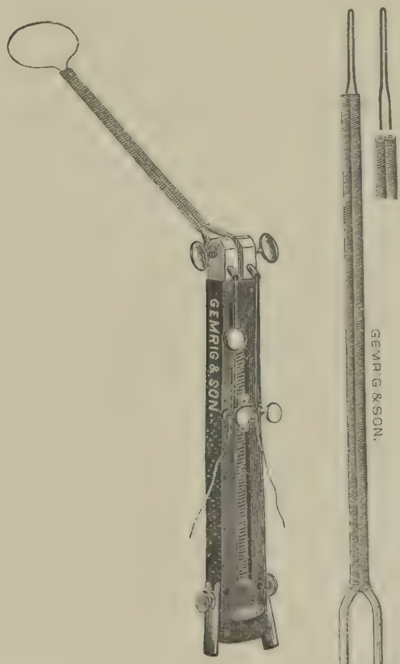
Hypertrophies.—As we have seen, both anterior, middle, and posterior hypertrophies of the cavernous tissue overlying the turbinated bones are of the most frequent occurrence, and give rise to stenosis, either partial or complete. A number of caustics have been recommended by authors on the subject, for the removal of these swellings, such as nitric acid, chromic acid, acetic acid (glacial), Vienna paste, actual and galvano-cautery, and their use is attended with more or less success; but it has been my experience that all chemical caustics, if applied to the mucous membrane over the hypertrophies in a sufficiently concentrated form to destroy the tissue below, give rise to so much pain and subsequent extensive inflammation that I have found it necessary to discard them. The same is true of the actual cautery with a glowing wire, for the amount of metal of the instrument is so small that it cools before we can apply it to the desired spot in the nasal cavity, and then only scorches the mucous membrane without destroying any of the deep-seated tissue. Furthermore, chemical caustics cannot with safety be applied to posterior hypertrophies, as their action cannot be readily checked by neutralizing agents.

I have found that the galvano-cautery is the most satisfactory agent in removing anterior and middle hypertrophies, if they are not so large as to press against the septum, thus preventing the introduction of the platinum loop, and the application should be made in the following manner: A pledget of cotton saturated with a four per cent. solution of cocaine, is introduced into the nostril and placed over the hypertrophic portion to be operated on, and left *in situ* for about ten minutes. A stronger solution may be used if it is important to save time, but no better results are obtained by it, except that it acts more quickly in anæsthetizing the mucous membrane.

A metal nasal speculum is then introduced into the nostril, until its end has passed the vestibule and the hypertrophy is brought into view; then a slender galvano-cautery knife set at an angle to the handle (Fig. 74), so as not to obstruct the view by the hand holding the instrument, is introduced. This galvano-cautery knife is composed of two pieces of stout copper wire, having holes drilled in their ends which are flattened by hammering, and they are insulated from each other by suture silk wound around them in a figure-of-8 fashion throughout their whole length. A piece of platinum wire of the required length and thickness is then bent into a loop and hammered flat, and its ends are inserted into the flattened holes at the ends of the wires and pressed down until the loop is firmly fastened. This arrangement enables the operator to fashion his own loops to suit the requirements of the different cases, and makes him independent of the instrument-

makers; while the copper wires can be made of considerable thickness, thus introducing but little resistance to the electric current in its passage through them. The handle is so arranged that the knife

Fig. 74.



Seiler's galvano-cautery handle with loop and knives.

can be inserted at different angles, and has a screw attachment for drawing in the wire when the instrument is to be used as a galvano-cautery snare for the removal of larger tumors. The current from the battery is then passed through the knife, and when

the latter is at a cherry-red heat, an incision is made through the mucous membrane into the cavernous tissue of the hypertrophy. It is of great importance to have the platinum loop at the proper temperature when the incision is made, for if it is too hot considerable hemorrhage will follow, and if too cold the application is very painful. Care should also be exercised in protecting the skin of the vestibule, for if it is touched with the hot instrument the pain is very considerable and lasting. If the knife is small enough, it is not necessary to protect the mucous membrane of the septum, and even if a cut is made into it by accident no harm is done. The cut should be carried down to the surface of the turbinated bone and the operator can readily feel the grating of the edge of the platinum loop when the bone is reached.

The immediate result of the incision is the formation of an eschar, and of a certain amount of inflammation which stands in a direct ratio to the extent of the burn, and, therefore, not too large an incision should be made at any one sitting; extensive inflammation having followed the operation in some cases where too much tissue had been destroyed with the galvano-cautery knife. Care should also be taken not to burn the tissue while in a state of active inflammation, and the galvano-cautery should never be applied until the mucous membrane has been treated with the alkaline solution and the iodine applications, so as to reduce the hyper-sensitiveness and the consequent risk of excessive inflammation.

The ultimate result of the operation is the formation of bands of cicatricial tissue, which by their contraction bind down the swelling, uniting the sur-

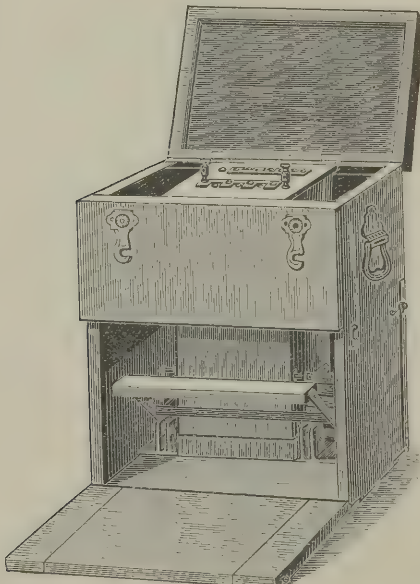
face of the mucous membrane with the periosteum of the turbinated bone in the line of the incisions, and thus prevent the stenosis. The number of incisions necessary to obliterate the hypertrophy will depend upon its size and firmness, but from two to four are usually sufficient.

In some cases where the mucous membrane is peculiarly sensitive, the operation is followed by an acute coryza within twenty-four hours, which can, however, in a great measure, be prevented by blowing some of the morphia and bismuth powder into the nostril immediately after the burning has been accomplished. As a rule, however, no inflammation, except in the immediate neighborhood of the burn, follows, and the operation, if properly performed, is almost painless.

To insure this result, however, the temperature of the loop must be under the perfect control of the operator, and as the galvano-cautery batteries in the market do not admit of a nice and immediate adjustment of the amount of current sent through the platinum loop, I devised a battery which, having been perfected in its details by Mr. Otto Flemming, has given entire satisfaction in this and other particulars. This battery (Fig. 75) consists of a series of carbon and zinc plates connected for quantity—*i. e.*, all the zincs as well as the carbon plates are united together, and the circuit is completed through the battery fluid, on the one hand, and through the platinum loop, which, by means of conducting wires, is connected with the terminal binding posts, on the other. This system of plates is mounted on a platform which is fastened near the top of the box, so

that they hang from it into the interior of the box. Immediately beneath the plates is a hard-rubbr cell containing the exciting fluid, mounted upon another platform, which can be raised or lowered by means

Fig. 75.



Seiler's galvano-cautery battery.

of a treadle projecting from the box. This treadle is jointed, so that by folding it up it can be placed inside of the box out of view and harm's way. When it is depressed the platform with the cell rises, and the system of plates is immersed in the exciting fluid, whereby the current is established. The height to which the cell is raised determines the amount of

current, and consequently the amount of heat in the platinum loop, for the higher the cell the more surface of the plates is exposed to the action of the liquid, and the more current is developed. As the treadle is actuated by the foot of the operator, it will be seen that he can control the amount of current during the operation without the aid of his hands or of an assistant, as is necessary in the case of the ordinary galvano-cautery batteries, and can regulate the temperature of the knife to a nicety.

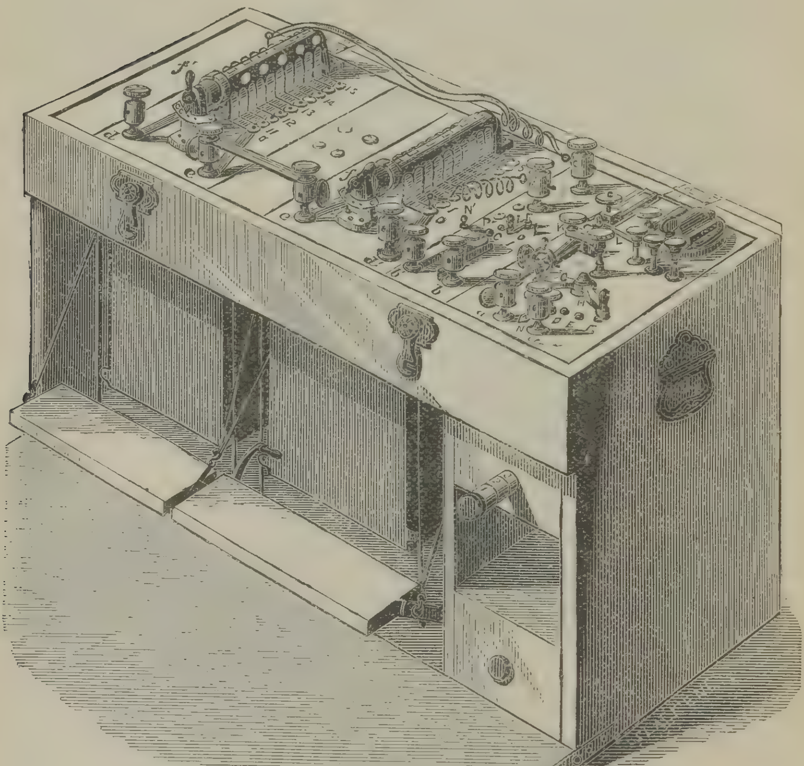
The rubber cell being large, contains a large amount of fluid, and as the plates are entirely out of the liquid when the platform is lowered, the liquid is not readily exhausted, so that the necessity of refilling the cell with fresh liquid does not occur very often; a point, the advantage of which will be apparent to every one who has ever used a battery with small cups which require refilling after each operation.

The battery of one cell is sufficient for the operations in the nose, but when larger operations are to be performed in which the heat has to be kept up for a considerable time, a two-cell battery should be employed.

As both the faradic and the galvanic current of electricity are frequently used in the treatment of diseases of the throat and nose, the advisability of having a battery which would yield the different forms of current presented itself, and at my suggestion Mr. Flemming made the universal battery (Fig. 76), which in principle is the same as the galvano-cautery battery, except that it contains two systems of plate instead of only one, which, by a

commutator, can be combined either for quantity, when the battery is to be used for galvano-cautery, or for intensity, when the galvanic current is de-

FIG. 76.

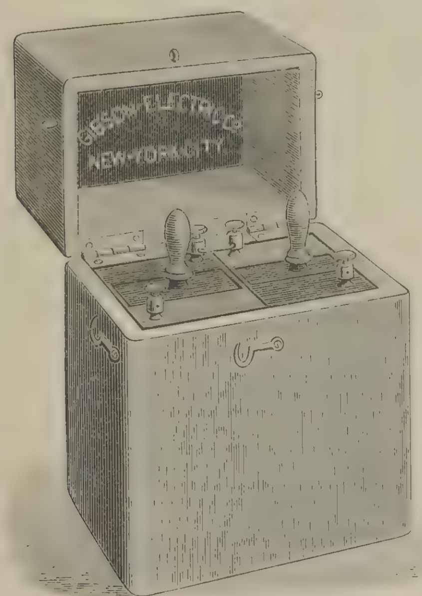


Seiler's universal battery.

sired. In the latter instance, the rubber cells containing the liquid must be changed for cells which are subdivided, so as to give for each pair of plates

of carbon and zinc a separate compartment. This change can be effected with very little trouble, and in a very short time, and then a galvanic battery of twenty cells is obtained which may be employed to run the electric motor, or give an electric light, as well as for medical use. In the same box containing

FIG. 77.



Gibson's storage battery.

the cells and plates is inserted a galvano-faradic apparatus, which is independent, and may be removed for the sake of portability. This battery thus will be found a most useful piece of apparatus in the office.

A more serviceable and less cumbersome battery has lately been introduced by the Gibson Electric Company, of New York, which consists of a storage battery of small size, containing one, two, four, or more cells, according to what is desired, and giving a current which is amply sufficient for all galvano-cautery operations (Fig. 77). Each cell has an electro-motive force of two volts and a current strength of about six ampère hours, so that for the smaller operations in the nose the current must be reduced. This can easily be done by introducing a resistance into the circuit, which need not be changed after the proper heat of the platinum loop has been obtained, because the current given off by a storage battery is constant until the charge is exhausted. A battery of this kind can be charged from a few cells of the ordinary telegraph battery, or it can be placed in the circuit of an incandescent light circuit, in place of a lamp. The time of charging varies according to the ampère strength of the primary current, while, when fully charged, the battery can be used for a very large number of operations before becoming exhausted. A battery of four cells is sufficient to light up one of the electric laryngoscopes for a considerable length of time.

When the anterior hypertrophies are very large, or in cases of posterior hypertrophies, the galvano-cautery is not applicable, and I then prefer the Jarvis' snare for removing them.

This admirable little instrument (Fig. 78) consists of a small canula about seven inches long, made of steel. About four inches from the lower end is a cross-bar, and the portion between this and the end

is threaded and carries a screw nut, which, by being turned, travels up or down. A portion of the circumference of this threaded piece of the canula is filed flat throughout its entire length, and has lines engraved across its face. Over this and behind the nut slips a tube which is fitted to the flattened screw so as to prevent its turning around, and has a slit cut into that portion overlying the flat surface of the threaded piece of the instrument, so that the division lines can be seen through it. This tube carries on its end two retention pins and a screw cap, by means of which the ends of the wire are fastened. Thus it will be seen that by turning the nut the tube will be pushed downward, and the wire loop projecting from the distal end of the canula is thereby made smaller. The end from which the wire loop projects, and which, during the operation, is pressed against the tissue, has an olive-shaped tip to prevent injury to the tissue. The opening in this tip should be oval to prevent the turning of the loop during the introduction of the instrument into the nose. A short curved piece of canula, with tip of the same shape as the one just described, may be substituted in some instruments for the straight canula, and it can then be used for ablating the hypertrophied pharyngeal tonsil. The wire used for anterior hypertrophies should be a fine annealed steel piano-wire, and is

Fig. 78.

Jarvis' snare.

sold by dealers as No. 0, while for posterior hypertrophies, and for the pharyngeal tonsils, it should be several numbers thicker.

Supposing that we have a case of anterior hypertrophies which are to be ablated with the snare, we proceed as follows: The parts are first anæsthetized with cocaine solution in the same manner as was described above, for the operation with the galvano-cautery knife. The base of the hypertrophy is then transfixed with a flat and slightly curved needle, having a light metal handle (Fig. 79). A piece of the thin steel wire having been cut of the required length, both ends are pushed through the canula, and are fastened securely to the sliding tube by

Fig. 79.

Jarvis' transfixing needles.

winding them around the retaining pins, and screwing the cap home. The loop, which should project from the olive-shaped tip for about three-quarters of an inch, longitudinal diameter, is then passed around the handle of the transfixing needle, and over the growth and point of the needle as it emerges from the tissue, and traction is made on the sliding tube until the wire encircles the swelling. The tissue is then gradually snared off by turning the nut, which, pushing the sliding tube down, draws the wire loop through the tissue into the tip of the canula. When

the wire has passed entirely through the swelling, which it does generally with a jerk, the hypertrophy comes away sticking to the transfixing needle. The operation is, however, by no means easy to perform, owing to the fact that it is often very difficult to get the wire loop over the projecting point of the needle, so that the snare has to be frequently withdrawn and reintroduced before the desired end is accomplished.

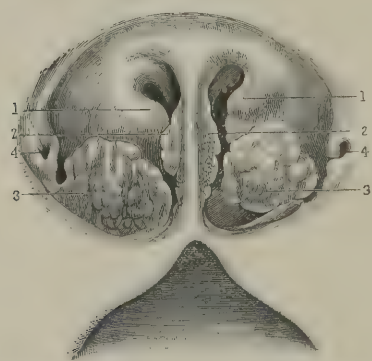
Fig. 80.

Seiler's claw-attachment to Jarvis' snare.

In order to overcome this difficulty I have lately devised an attachment to the Jarvis' snare which facilitates the operation very materially (Fig. 80). This attachment consists of a pair of curved claws, projecting beyond the end of the canula, and separated from each other about one-half of an inch. A slide, having a long stem, by which it can be pushed forward, slides over the shanks of the claws, and by this motion closes them against each other, raising them slightly at the same time from the canula. In using this instrument, the canula with the claws open, and the wire loop of the proper size, is introduced into the distended nostril, the claws are pressed through the loop against the hypertrophy and closed by pushing the slide forward, when the piece of tissue grasped between them will be pulled through the wire loop, which should then be tightened around it and the

hypertrophy cut off slowly. The piece which has been thus ablated is firmly held by the claws. The operation should occupy fifteen or twenty minutes, because it has been found that if the tissue is cut through quickly the pain is greater, and the hemorrhage sometimes quite copious. If, on the other hand, it is done slowly, the patient experiences but little pain, and hardly any bleeding follows the operation. The wound left is very small on account of the compression of the mucous membrane during the process of snaring, and generally heals by granulation, so that no special treatment is necessary. Middle hypertrophies and hypertrophic tissue on the septum can be removed in the same manner.

FIG. 81.



Rhinoscopic image in a case of cleft palate with posterior hypertrophies.

1 1. Middle turbinated bone. 2 2. Hypertrophic tissue on vomer. 3 3. Posterior hypertrophies on lower turbinated bone. 4 4. Opening of Eustachian tube.

If we have to deal with a case of posterior hypertrophy, however (Fig. 81), the manner of operating

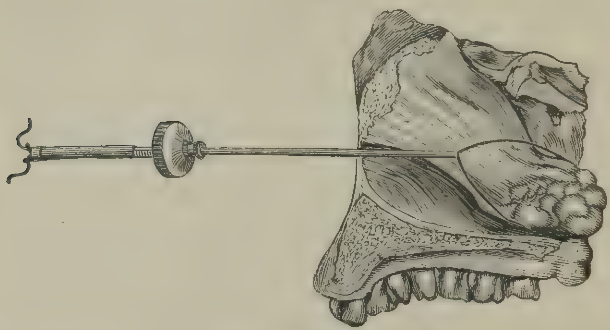
is quite different. In this operation it is of great importance that the size of the wire loop should be measured before introducing it into the nasal cavity, and this may be done in the following manner:

After the ends of the wire have been made fast a piece of hard wood, shaped like a wedge, is thrust into the loop. The triangular base of the wedge is rounded off, and its narrowest part rests on the tip of the instrument, while the wire is drawn tightly over it by pulling upon the sliding tube. The circumference of the wedge is first measured by making a wire loop of the same size and drawing it just within the orifice of the tip, at the same time noting the distance traversed by the slide-tube. This distance is added to that previously registered by the slide-tube when it clasped the wooden wedge, and the number found will be that indicating complete section of the hypertrophied tissue.

The loop might be measured by drawing it into the instrument, but then the wire becomes "kinked" and is very apt to break at that point during the operation, while when measured in the manner described the loop retains its shape. Before introducing the instrument into the anterior nares, when posterior hypertrophies are to be removed, the loop should be made as small as possible without distorting it, by pulling down the sliding-tube. As soon as the end of the instrument has entered the post-nasal cavity, the loop is again enlarged by pushing up the tube to which the ends of the wire are fastened. This has the effect of throwing the loop out and bending it toward the growth to be removed, thus greatly facilitating the catching of the hyper-

trophied tissue (Fig. 82). The cross-bar on the instrument indicates the position of the tube in relation to the natural bend of the loop. It is of great advantage, especially for the inexperienced operator,

FIG. 82.



Jarvis' snare in position, showing loop around a posterior hypertrophy. (JARVIS.)

to watch the motion of the loop in the naso-pharyngeal cavity by means of the rhinoscopic mirror, and by using the combined tongue depressor and rhinoscopic mirror (see Fig. 24), together with the tape and holders for retracting the soft palate, this can be accomplished with comparative ease. There is, however, as Dr. Bosworth has pointed out, no projection in the nasal cavity which could engage the snare that is not pathological and should not be done away with, and, therefore, the removal of posterior hypertrophies is usually undertaken by the experienced operator, who has educated the tactile surfaces of his fingers to such an extent that he *feels* the exact position of the wire loop in the posterior portion of the nasal cavity, and can dispense with

the preliminary operation of tying back the palate, which is very disagreeable *to both* the patient and the operator.

As soon as the wire has slipped into the constriction at the base of the hypertrophy, the loop should be carefully tightened around the tissue by pulling down the slide-tube. When the traction upon the wire becomes perceptible the milled nut is run down, further traction being made by rotating it. By giving a turn to the milled head until the patient winces, every minute at first, and later every three or four minutes, the growth can be snared off in the course of an hour or so. As soon as the point marked on the scale has been passed by the end of the sliding tube, a number of turns should be given to the milled nut to insure complete section of that portion of the mucous membrane overlying the end of the tube, and then the instrument can be withdrawn. The growth usually comes out clinging to the écraseur by a shred of tissue which has been drawn into it by the wire, but sometimes, although severed from its connection, it remains in the nasal cavity, and should then be removed at once with a pair of forceps. After the operation the patient should be cautioned against blowing his nose, for fear of opening the agglutinated venous sinuses by the mechanical vibration, and so starting a hemorrhage. If any bleeding should follow the operation, it can always be stopped by plugging the anterior nasal cavity with borated cotton in such a manner that the blood cannot flow out of the nostril. The blood then backs up forming a clot, which when it has reached the bleeding spot, will by its presence

and pressure stop the hemorrhage. While this clot is forming, which usually takes place within fifteen minutes, the patient should hold his head forward and spit out any blood which may flow into the pharyngeal cavity without, however, "hawking" it out. Styptics, and especially solutions of iron, should never be used in the nose as they act as irritants, and the coagulated, sandy blood becomes so tightly adherent to the mucous membrane as to be very difficult to remove, and in many cases gives rise to ulceration.

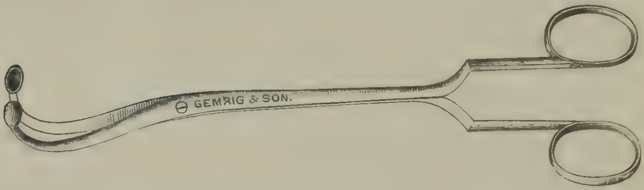
The slow and steady constriction of the tissue has the effect of agglutinating the walls of the venous sinuses and bloodvessels, and also of drawing the edges of the wound together, so that usually, as in the case of the operation for the removal of anterior hypertrophies, very little, if any hemorrhage results, and the wound heals by first intention without giving rise to any inflammation of the mucous membrane lining the cavity.

Localized thickenings of the cartilaginous portion of the septum or "*ecchondroses*," as they may be termed, which are not infrequently found in old cases of nasal catarrh, and which give rise to partial stenosis, especially if they are situated on the septum opposite to the pendent portion of the lower turbinated bones, may also very readily be removed with the wire snare in the same manner as the sessile anterior hypertrophies. The wire used in this operation should, however, be very thin, so as to cut readily through the cartilage, and the needle used for transfixing the base of the ecchondrosis must be quite strong, so as not to bend inward.

Adenoid growths in the vault of the pharynx, or hypertrophied pharyngeal tonsil, are best removed with the wire snare in the following manner: Having removed the tip from the end of the canula, the curved piece is screwed in its place, and a piece of wire inserted to form a loop, as in the operation for posterior hypertrophies. The loop is then bent in such a manner that when traction is made with the sliding tube it will bend backward; that is, in an opposite direction from the curve of the instrument. The loop is then passed behind the velum into the naso-pharyngeal cavity, and the tip of the canula is pressed against the wall of the pharynx. Traction then being made by turning the nut, the wire will encircle the growth and it may be snared off quite rapidly. As these growths consist of glandular tissue only, the pain is but slight, and little, if any, hemorrhage follows the operation. There is usually, however, some inflammation of the mucous membrane lining the naso-pharyngeal cavity of several days' duration, and the wound heals by granulation. If, as happens quite frequently, the glandular mass is rather flat, extending over a considerable surface of the vault of the pharynx, the snare will not take hold, and a pair of pharyngeal cutting forceps, of a peculiar bend, should be used to remove the growth piece by piece (Fig. 83). With children neither the snare nor the cutting forceps can be used with advantage, because the little patients will not hold still long enough either to apply the snare or to introduce the forceps more than once; and I have found that the hypertrophied glandular tissue can be gotten rid of most easily by scratching it off with

the finger-nail, which should, of course, be long and strong. If the operator does not possess such a natural surgical instrument, an artificial claw attached to a thimble may be used, as suggested by Dr. Farnham, of Milwaukee. In performing the

Fig. 83.



Seiler's pharyngeal cutting forceps.

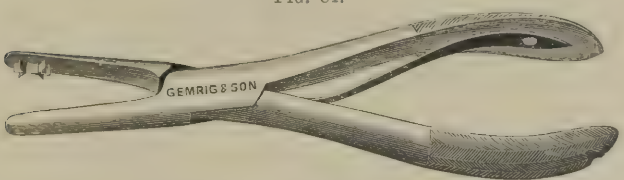
operation with the finger, the operator had best take the child on his lap sideways, letting its head rest on his left arm, and holding its hands down with his left hand. This position leaves his right hand and arm free, while the little patient is firmly held in the best possible position with its legs free to kick the air. As there is very little pain connected with these operations, they can all be performed without putting the patient under the influence of an anæsthetic, and thereby we have the advantage of the patient's conscious coöperation during the often difficult manipulations.

Deviation of the Septum.—Among the hard obstructions in the nose which the practitioner is called upon to remove for the cure of nasal catarrh, the most common is that produced by deviation of the septum, due either to the inflammatory process, or to injury to the nose by blows or falls. A variety of

operations have been recommended for the relief of this condition, and different authors advocate punching a round or oval hole into the septum, or cutting out a triangular piece of the cartilage, or shaving off the projecting portion with a curved knife, etc., but the simplest, easiest to perform, and at the same time very satisfactory operation, in a large number of cases, in which the deviation is confined to a portion of the cartilaginous plate only, and where there are no ecchondroses, is the following, recommended by Dr. Steel, of St. Louis.

With a pair of strong forceps (Fig. 84), which has inserted into one of its blades a number of knife-

FIG. 84.

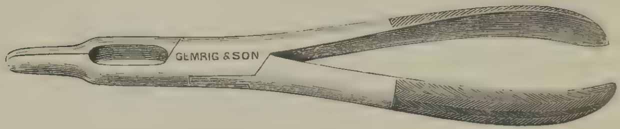


Steel's forceps for deviation of septum.

blades, at right angles to the surface and arranged in the shape of a star, the septum is punched at its greatest curvature once, or if the bend extends far back twice, by introducing the blade carrying the knives into the open nostril, and the unarmed blade into the closed one, and then compressing the handles. The punch is then removed, and with a pair of forceps having flat blades (Fig. 85) the septum is forcibly straightened, which becomes possible since the triangular pieces produced by the cut made with the punch lap, and thus the distance

from the base to the top of the septum becomes diminished. Having accomplished this the forceps

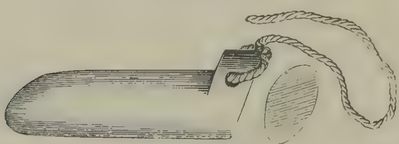
Fig. 85.



Adams' forceps.

is removed, and a wooden or ivory plug shaped to fit the cavity (Fig. 86) is inserted into the formerly

Fig. 86.



Nasal plug.

obstructed nostril, and is kept there for about forty-eight hours, when it is replaced by a plug of cotton, which must be removed daily until the cuts in the septum have firmly united, and the septum remains straight without support. In those cases in which ecchondroses are present, causing a localized thickening of the septum, these must be removed previously to the operation for straightening the septum, as they will not yield to the pressure exerted by the Adams forceps and the nasal plug; and, therefore, the septum will not become straight. Quite a large proportion of cases of deviation of the cartilaginous plate of the septum are due to external traumatism, such as falls or blows on the bridge of the nose, and

in them we usually find a fracture of the palate in a more or less oblique direction. This fracture is seen through the nostril as a ridge on the obstructed side and a V-shaped depression on the open side of the nose. In these cases the Steele punch is not applicable, and the best results are obtained by an operation suggested by Dr. John Roberts, slightly modified by myself. This operation is as follows: The mucous membrane in both anterior nasal chambers is first thoroughly anæsthetized with cocaine solution introduced with cotton pledgets, as already described, and also with a spray of cocaine after the pledgets have been removed. The well-oiled index finger of the operator's hand opposite to the obstructed side, is then slowly introduced into the nostril with the palmar surface toward the septum until the edge of the vomer is reached. This procedure, although apparently impossible, is readily executed, because the cartilaginous plate will give to the pressure, and it is not nearly as painful to the patient as might be supposed. The finger being *in situ*, the upper end of the fracture can readily be felt, and a sharp-pointed curved bistoury can be introduced through the other nostril, and with its point a small incision can be made through the septum opposite to the tip of the finger. A probe-pointed bistoury, also curved, is then introduced through this cut, and the septum is cut along the line of the fracture down to the columnar cartilage, the finger serving as a guide for the point of the knife. A little manipulation with the finger in the nasal chamber will suffice to cause the edges of the cut to lap over each other, and thus to straighten

the septum. The next step is to secure the septum in its new position, and this is accomplished by inserting a rather large hare-lip pin through the skin on the bridge of the nose at a point near the end of the nasal bone, carrying it downward and forward between the finger and the cartilaginous plate of the septum, and imbedding its point firmly in the floor of the nose by a few strokes of a hammer. In most cases one pin is sufficient, but if the cut in the septum is rather long and the nose of the patient large, another pin had better be introduced in the same manner a short distance from the first one. The finger is then withdrawn, the heads of the pins cut off to within about one-eighth of an inch of the surface of the skin, and the projecting ends protected by a pledget of cotton, which is held in place by a small strip of court plaster. These pins serve the same purpose as the nasal plug in the Steele operation, viz., to keep the straightened septum in position, and are preferable, because they do not obstruct the nasal chamber, nor do they exert any pressure upon the turbinated bone, and can, therefore, be left in the nose until the cut is healed, which usually occurs in about two weeks. All that is necessary during that time is to keep the nasal chambers thoroughly cleansed with the antiseptic solution. There is usually no difficulty in removing the pins with a pair of strong plyers, if they have been allowed to project sufficiently beyond the surface of the skin. But if they have been cut off too short, the cut end will disappear under the skin, partly because the pin has a tendency to sink in the floor of the nose, and partly because the bridge of the nose has

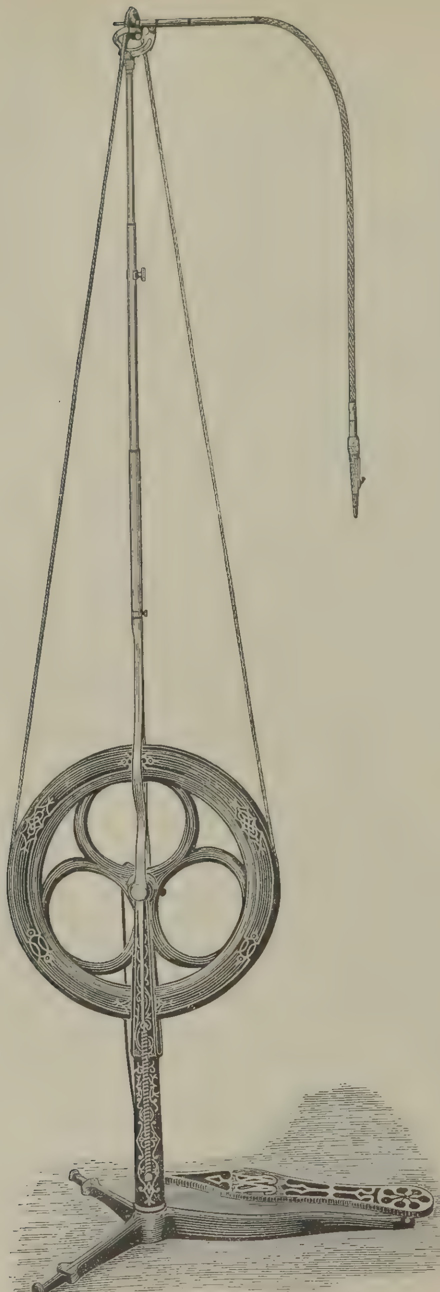
been raised by the straightening of the septum. The pin can then be pushed up by grasping the exposed portion in the nasal chamber with a pair of small jeweller's plyers, and by making a small incision in the skin over the end of the pin, it can be grasped and removed. There are, however, several cases in which the pin has never been removed, without doing any harm. The hemorrhage in this operation is usually insignificant, and stops of itself after a few minutes; or if it should be more copious, can easily be controlled by introducing pledgets of cotton into the nasal chambers, and placing them in such a position that they make pressure upon the bleeding vessels.

There is another class of cases in which the deviation of the septum is due to a dislocation of the cartilaginous plate and a disruption of its connection with the vomer or the superior maxillary bone. If such is the case, and there are no ecchondroses, the septum can be placed in its proper position by the introduction of the finger in the obstructed side and by manipulation the adhesions can be broken under the mucous membrane without making any cut. A large cotton plug in the obstructed side will keep the septum in position, and union takes place in a very few days.

As a rule, very little swelling and inflammatory disturbances follow any of these operations, and it is but rarely that we experience any trouble from this source.

As deviation of the septum causes deviation of the nose, and disfigures the face, the operation is often performed solely for the sake of improving

Fig. 87.

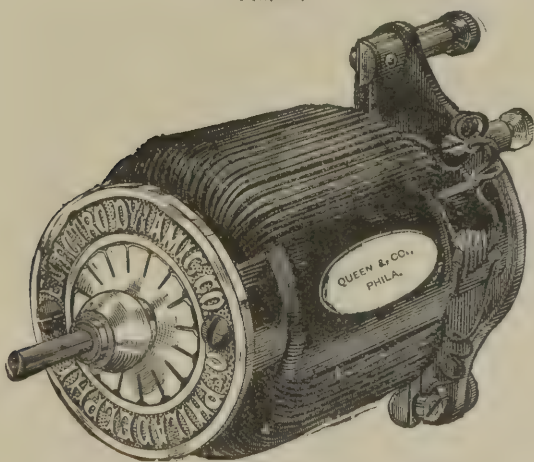


Dental engine.

the looks of the patient, and in that respect is very satisfactory.

Bony obstructions.—When the localized thickenings of the cartilaginous septum have become ossified, as they frequently do, or when the obstruction in the nose is due to an exostosis of the bony septum, or due to an enlargement of the turbinated bone itself, and not only of the soft tissues overlying it, or finally when a bony spur from the palatine process is so large as to cause stenosis, neither the wire-snare nor the galvano-cautery is of any avail, and the obstructions must be removed by breaking them

FIG. 88.



Electric motor.

up with a drill and burr, or with a chisel, gouge, and hammer, or cut off with a saw. For these operations a dental engine (Fig. 87), such as is used by dentists, has to be employed to revolve the drill or burr

rapidly enough to cut away the bone, or, better still, a small electric motor (Fig. 88) to which the tools are attached, either directly to its spindle or by interposing a short flexible shaft between the spindle and the handpiece carrying the tools. With this apparatus the speed of the drill can be regulated to a nicety, from a few hundred to fifteen thousand revolutions per minute, by means of the universal battery (Fig. 76), or any other battery which will give a current of about eight volts and one to two ampères. The storage battery of four cells is perhaps the best for the purpose. When used for operations, the motor whose power is equal if not greater than that of the dental engine, is suspended from the ceiling by cords which run over pulleys and carry counter-weights, so as to balance it in any position it may be placed in. This arrangement relieves the hand of all weight, and thus a much more delicate manipulation of the tool is possible than can be obtained when the dental engine is used, for in the latter instrument the hand has to support the weight of the hand-piece and flexible shaft or arm, and besides a good deal of the motion of the foot, working the treadle of the fly-wheel, is communicated to the hand, making it unsteady.

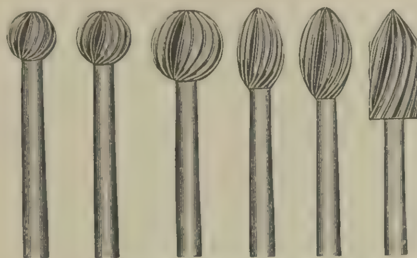
The tools used in the operation are fluted and twist drills (Fig. 89), and burrs (Fig. 90) of various shapes and sizes. In order to protect the parts on the opposite side of the nostril when cutting away bony projections from the surface, Dr. Goodwillie, of New York, has devised a shield within which the burr revolves (Fig. 91). In the case of enlargement of the turbinated bone, and bony spur from the

palatine process, the operation is performed as follows: The bony obstruction is first riddled with a number of holes made with a cutting drill, and its

Fig. 89.

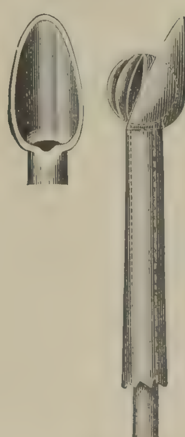
Drills for dental engine.

Fig. 90.



Burrs for dental engine.

Fig. 91.



Burr with shield.

substance is then broken down with a coarse burr, the diameter of which is greater than that of the drill, and finally any shred of mucous membrane or spicules of bone which remain are cut off with a pair of scissors. After the lapse of twenty-four hours, it is generally necessary to trim off the surface of the wound with scissors, as projections which have been overlooked in the first instance, then show themselves, after which the wound is allowed to heal up.

In cases where the bony obstruction springs from the flat surface of the septum, a round or olive-shaped burr, encased in a shield, is pressed against the projection, and the osseous tissue is cut, or rather ground away, until the normal surface is obtained. There is less pain or hemorrhage connected with these operations than might be expected, because the rapidly revolving drill or burr cuts only into the hard and resisting substance of the bone, while the soft tissue of the bloodvessels and nerves is not injured. In cases where it is desirable, the bone can be removed without breaking the periosteum, except to give entrance to the cutting burr.

Usually but a very moderate amount of inflammation of the mucous membrane of the nose follows these operations, and the wound in the soft tissues heals readily within a few days. As a rule, it is more convenient to place the patient under the influence of an anæsthetic, so as to have perfect control over his movements; although it is not absolutely necessary, as the pain can very readily be borne when cocaine is used.

In those cases of ecchondrosis which, as already

described, present variously shaped projections from the surface of the septum, the drill and burr are not applicable, and various writers have suggested and used a large variety of different instruments for these operations, such as the saw and knife, the plough, the gouge, the snare, etc.; but a careful consideration of the requirements of individual cases will at once show that none of these instruments can be successfully used in all cases to the exclusion of the others, and the armamentarium of the operator should include them all.

But we must take into consideration that most operators have a particular fondness for this or that instrument, and prefer to operate with it rather than use any other, if this is possible; probably because they have acquired especial dexterity in its manipulation. It is, therefore, natural that they should praise their pet tool, and obtain results with it which others, with less dexterity in its use, can never hope to arrive at.

The object is to remove the redundancy of tissue as thoroughly and quickly as practicable, leaving a plain surface without ragged edges, and to perform the operation with as little pain and inconvenience

FIG. 92.

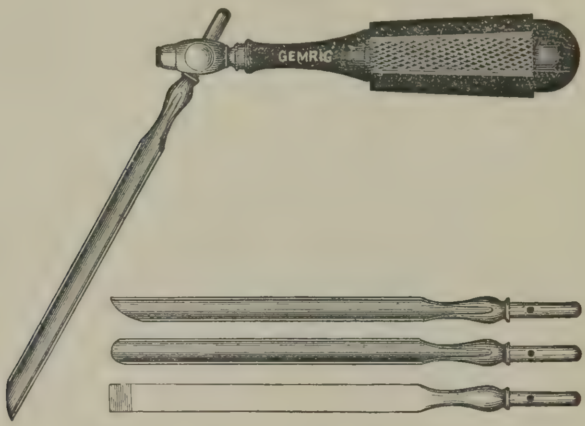
Seiler's cartilage knife, curved on the flat.

to the patient as possible. And this can only be done by adapting the instruments to the requirements of the case.

If the ecchondrosis is in the shape of a conical

projection or of a ridge running from below upward, and if no ossification has taken place, I prefer a small, double-edged knife, slightly curved on the flat (Fig. 92), with which an incision is made first from

Fig. 93.



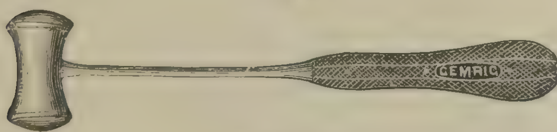
Seiler's nasal gouges and chisel, with handle.

below upward to about the middle of the excrescence, and then from above downward until the two cuts meet, and the cartilaginous projection is ablated. If there exists a hard centre which cannot be cut through with the knife, the two cuts from below and above should be carried to this centre, and then a flat chisel (Fig. 93) used to cut through the bony portion, which is easily effected by tapping the handle slightly with a leaden mallet (Fig. 94).

The two cuts are necessary because the knife, after having passed through the cartilaginous tissue, finds not sufficient resistance in the mucous membrane if

the operation is made with one sweep of the knife from above downward, and the ablated piece falls over into the mass of coagulated blood, being still attached to the surface of the septum at its lower

FIG. 94.



Leaden mallet.

edge by the mucous membrane. It is then difficult to grasp with the forceps, and much time is lost in finally severing the mucous membrane.

If, on the other hand, the shape of the ecchondrosis is shelf-like, with a downward-sloping upper surface, and a concave under surface separated from the floor of the nose by a narrow space, and running backward for some distance, we may take it for granted that we have to deal with an ossified excrescence, and proceed as follows: After having thoroughly anæsthetized the parts with cocaine solution, a grooved director, slightly bent at an angle, is introduced into the space between the floor of the nose and the under surface of the shelf-like projection,

FIG. 95.

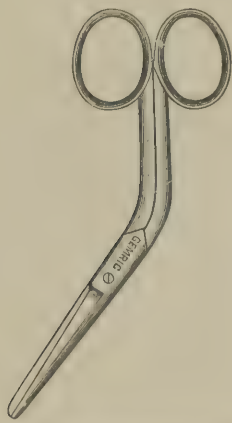
Seiler's plough-shaped knife.

with the groove upward. The nostril is then dilated to its full extent with Bosworth's or Jarvis' self-retaining nasal dilator, and the dull point of a plough-shaped knife (Fig. 95) is inserted into the

groove of the director, and is pushed backward so as to cut through the base of the projection; very much in the same way as a wood-carver uses a similar tool. As soon as the bony centre presents an obstacle to the further progress of the knife, the latter is removed and a gouge—the cutting edge of which is slanting—is inserted with its point into the groove of the director, and with a few blows from the mallet upon the end of the gouge, the ossified portion is cut through. In order that the view of the nasal cavity be not obstructed by the handle of the instrument and the hand holding it, I find it advantageous to insert the tool into the handle at an angle of about sixty degrees, fastening its stem by a set-screw, and allowing the former to project slightly so as to receive the blows from the mallet in a direct line with the direction of the cut to be made. The hand holding the cutting instrument should be steadied against the chin of the patient, so as to prevent injury to the parts beyond the projection, which might easily result from the cutting edge or point of the instrument getting out of line and going beyond the posterior end of the projection, into the vault of the pharynx. A little practice soon enables the operator to feel when the gouge has cut through the hard tissue. The tool is then removed, and, keeping the grooved director in position, a pair of scissors bent at an angle (Fig. 96) is passed along its groove, so as to sever any portion of the mucous membrane at the upper surface of the shelf which may not have been cut by the plough or gouge. A straight chisel is not as advantageous as the gouge, because it cannot be so easily kept in the

line in which the cut should be made; and, although the cut surface is slightly concave, I have in no case observed any retardation in the healing of the wound from this cause. In the case of a union between the

Fig. 96.



Seiler's angular scissors

turbinated exostosis and the ecchondrosis of the septum, I have found it best to divide the exostosis first, with a saw (Fig. 96), close to the turbinated bone, and then to ablate the ecchondrosis with the knife and chisel, or gouge. The ablated piece of cartilage is then grasped with a pair of rat-tooth forceps and

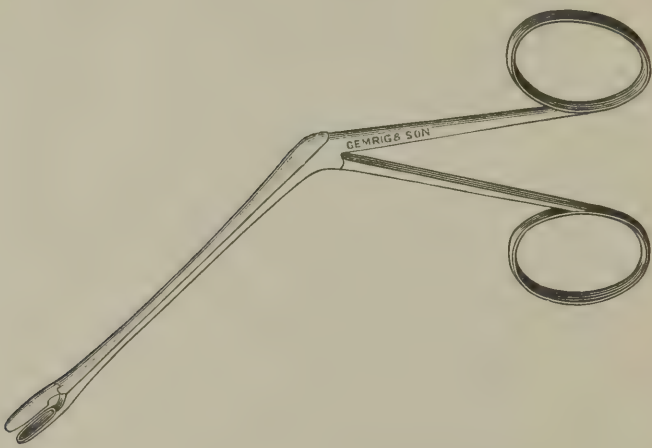
Fig. 97.

Nasal saw.

removed from the nostril, while any small projections not removed by the gouge are best cut off with the Farnham alligator forceps (Fig. 98).

These operations are absolutely painless if the cocaine has fully anæsthetized the parts, and the only objection made by the patients is the jarring produced by the blows of the mallet upon the end of the gouge or chisel. The hemorrhage resulting

Fig. 98.



Farnham's alligator forceps.

from these cutting operations, as a rule, is comparatively slight, and can always be controlled by placing a pledget of borated cotton against the wound for a few hours. As soon as all oozing has stopped, this should be removed and the nasal cavity should be washed out twice daily with the antiseptic solution, so as to prevent any sepsis. The healing process is usually complete in about ten days, but may, in some cases, be prolonged for a few days more. There is no soreness of the nose, and no great amount of inflammation of the surrounding mucous membrane fol-

lowing the operation, and the patient is able to attend to his duties at once.

When it is necessary to place the patient under the influence of a general anæsthetic for operations within the nose, and the operator thus loses the coöperation of the patient, the posterior nares must be plugged to prevent the blood from flowing into the larynx and choking the patient.

Plugging the nose is an operation which the practitioner is frequently called upon to perform, and it will therefore not be out of place to describe it here. In text-books on surgery we find an instrument—Belloque's canula—recommended for this purpose, which, however, if at hand, in many cases proves useless on account of its great thickness. It will be found that the nose can be plugged just as well, and often better, in the following manner: A large-sized Eustachian catheter, or, if that is not at hand, a female catheter, is introduced through the lower meatus of one of the nostrils until its end comes in contact with the wall of the pharynx. A catgut string or a piece of twine, well waxed to make it stiff, is then pushed through the catheter, and when its end appears below the margin of the velum, it is seized with a pair of forceps and drawn out through the mouth. A wad of cotton, tow, lint, or any other substance which will serve the purpose, having been previously tied to a string in such a manner that two long ends hang from it, is then drawn into the pharyngeal cavity by tying one of the ends to the catgut string as it projects from the mouth, and pulling at the end projecting from the nostril, at the same time removing the catheter. The plug of

cotton will thus be wedged into the post-nasal cavity, preventing the escape of blood into the pharynx. The catgut string is then detached from the string to which the cotton is tied, which hangs out of the nostril, and may be cut off close if the plug is to remain in place for any length of time, while the other end of the string, which remains in the mouth, should be secured to the teeth in such a manner that the velum is not hindered in its motion. When the plug is to be removed, all that is necessary is to pull at this end of the string, when the plug will become detached, and can be drawn out through the mouth.

CHAPTER XV.

HAY-FEVER, OR CORYZA VASO-MOTORIA PERIODICA.

Hay-fever, as well as the numerous forms of neurotic coryzas which we so frequently meet with in this country among the more educated class of patients, is a chronic nasal affection which, depending, as it does, upon a greater or less disturbance of the various nerves supplying the nasal mucous membrane, deserves more than a passing notice in this volume. For at the present day the intelligent physician is not satisfied with the explanation of the causation of this affection given by the earlier writers, and still accepted by the general public, viz.: that it is caused by the introduction into the nasal chambers of pollen grains or vibrios; nor can he

accept the dictum of the so-called hay-fever associations: that the disease is incurable, and the only relief is obtained by a sojourn during the season in certain localities, because the various reflex symptoms due to nasal disease, already mentioned in the foregoing pages, clearly indicate that there must be some pathological condition present in the nasal chambers which, when irritated more than usual, by the introduction of dust, pollen grains, or other external influences, causes all the symptoms of the so-called hay-fever, or better named by J. N. Mackenzie, of Baltimore, coryza vaso-motoria periodica. The scope of this hand-book is, however, too limited to allow of a lengthy dissertation on the various theories advanced from time to time on the minute pathology of this affection, so that the author can only give a mere outline of them, and must refer the reader for further and a more detailed description to the various papers by Daly, Roe, J. N. Mackenzie, Bosworth, Woakes, and others.

History.—The first description of the symptoms of hay-fever was given by Rostock, in 1819, and a further paper by the same author, in which he gave the affection the name of "summer catarrh," appeared in 1828. These papers were followed by a short paper on "Hay Asthma," by Gordon, in 1820, and by a similar one by Ellioston, in 1831, in all of which the affection was ascribed to the introduction of pollen grains into the nasal chambers. In 1862, Phœbus, of Giessen, published a collective investigation, and he was followed by Abbott Smith, Pirrie, and Moore, who also expressed the opinion that emanations from flowering plants were the sole

cause of the affection. In 1869, Helmholtz published his theory of hay-fever, which was, that as he had by microscopical examination of the nasal discharges discovered certain vibrios, these were the cause of the affection, and by destroying them with germicides, the disease could be cured. This assertion was, however, not substantiated by extended trials. Morill Wyman, in 1872, described the disease as it was prevalent in the United States, and made mention of the fact that there were two distinct varieties, viz.: the rose cold in May and June, and the hay-fever in August and September. Blackley, of Manchester, in 1873, published an excellent treatise on this disease, and was followed by Beard, of New York, in 1876, with a collective investigation, and finally, Marsh, in 1877, published an essay, in which he reiterates the pollen theory of the causation of the disease, which had been accepted as proven by all the authors before him. In 1878, Dr. Judd, of Philadelphia, submitted a graduation thesis to the Faculty of Jefferson Medical College, in which he expressed his opinion that the disease is not altogether due to pollen grains, but is more of the nature of a nervous affection.

Not until Daly, of Pittsburg, in 1881, called attention to the fact that other than external causes could produce hay-fever, and that by the removal of such causes the disease could be permanently cured, was the faith in the pollen theory shaken; but it needed the corroboration of Roe, of Rochester, Bosworth, of New York, J. N. Mackenzie, of Baltimore, and many other laryngologists of America and Europe, to establish the fact firmly that pollen or other dust

floating in the atmosphere was but *one* of the excitants producing an attack of the affection, but by no means the original cause of the disease.

Symptoms. — There is a variety of vaso-motor coryzas, which in their symptomatology differ from each other mainly in the variety and duration of the symptoms, in the periodicity or non-periodicity, and in the popularly accepted or actual exciting influence which produces the attacks. Thus we have the hay-fever, hay-asthma, or autumnal catarrh, which recurs with unvarying regularity at the end of August, and lasts, with slight variation in the intensity of the symptoms, until the first frost appears. As its exciting cause, pollen grains, and particularly the pollen of the rag-weed, are named. Then we have the so-called rose cold, which is also regular and periodic in its appearance, and comes on at the end of May, lasting as long as the roses are in bloom. Its exciting cause is supposed to be the pollen of the rose. The more rarely met with forms are the horse cold, which is developed as soon as the patient exposes himself to the emanations from a horse or cow. The peach cold, the exciting cause of which is said to be the down from the skins of the fruit. The snow cold, which is apparently caused by the sharp, cold air produced by the evaporation from the surface of the snow; the millers' cold, or asthma, excited by wheat flour in some cases and rye flour in others, and a variety of other forms in which the attacks are excited by a variety of substances, and, finally, a form occasionally met with, which is not due to any external irritant, but is brought on by sexual excitement. In all these forms of the disease, the attacks

usually last but a short time, from a few minutes, as in the form caused by sexual excitement, to a few days, as in the peach cold. Why so many different exiting causes can produce the same symptoms in different individuals is impossible to say, and we must fall back upon the convenient explanation, by idiosyncrasy, which in reality is no explanation at all. The symptoms of an attack of any of these forms of vaso-motor coryzas are those of an ordinary acute cold in the head of an aggravated form. First, a sense of dryness and itching of the nose, violent sneezing, especially in the morning, a sense of fulness of the nose, followed by a profuse watery discharge. After a short time conjunctivitis, lachrymation, and photophobia are added, together with a dull frontal or occipital headache, frequently neuralgic in its character, make their appearance; and in the more aggravated forms, a slight hacking cough, hoarseness, and asthma, more or less severe, are noticed. At the same time the nasal discharge becomes thicker and of a yellowish color, difficult to remove from the nasal cavities by blowing.

The edges of the nostrils as well as the skin between the nose and the upper lip become red and sore from the action of the nasal discharge and the frequent wiping of the nose. General febrile disturbances are more or less pronounced during the first few days of the attack, characterized by increase of pulse and temperature and a feeling of malaise.

These symptoms in the long-continued attacks of hay-fever and rose-cold vary from time to time in intensity, being intensified by exposure to dust,

heat, draughts of cold air, the ingestion of hot or highly spiced food, and other excitants.

An inspection of the nasal cavities reveals no specific pathological change of structure, and the condition of the mucous membrane is the same as is noticed in an ordinary acute coryza, viz., intense congestion of the mucous membrane, general turgescence of the turbinated erectile tissue, with profuse serous and mucous discharge. The congestion extends into the naso-pharyngeal cavity, and later involves the laryngeal as well as the tracheal mucous membrane.

Etiology.—The causes producing this affection, as has already been indicated, must be looked for in a chronic pathological condition of the nasal cavities, together with a vitiated action of the nerve-centres, and an exciting cause producing the distal nerve irritation. Thus we have, in reality, three factors which must act in conjunction to produce the attacks, and if any one of these factors is removed, the disease fails to make its appearance. In this way only can we explain the immunity from an attack of hay-fever by the removal of the patient to a locality free from the excitant, and the immediate return of the symptoms when he is exposed to the to him deleterious influences floating in the atmosphere, or the immunity of others in whom the pathological conditions in the nose exist, and also are surrounded by the same irritant, but who, nevertheless, do not suffer, owing to the fact that their nerve centres are not altered. The first of these factors, viz., the pathological condition of the nasal chamber, may comprise any of the various changes mentioned in

the foregoing chapter, such as anterior, middle, or posterior hypertrophies; exostoses or ecchondroses of the septum; deviation of the septum, or the pressure of foreign bodies, rhinoliths, or polypi in the nasal chambers; but above all, hyper-sensitive areas on the surface of the nasal mucous membrane, which may readily be distinguished by their heightened color, and by the fact that a slight elevation of the surface throughout their extent occurs when they are touched with the end of a probe.

The second factor consists in a diseased, or at least altered, condition of the nerve-centres, the vitiated action of which is induced by the irritation of the distal nerve fibres in the nose. This alteration gives rise to the train of near and remote symptoms by reflex action. This can readily be demonstrated by touching one of the hyper-sensitive areas in the nose of a hay-fever patient at a time when he is not suffering from an attack, for the mechanical irritation will be immediately followed by the appearance of all the early symptoms, and such an artificially produced attack will last from a few minutes to several hours, and, in some cases, even for days, though it be the middle of winter.

Very little need be said about the third factor, the external irritant, as it is of the least importance, for, as has already been said, a large variety of different substances will cause an attack in as many different individuals, and no particular pollen-grain or emanation from plants or animals can be singled out as the one which is the offending substance in all cases.

Treatment.—The treatment must be directed to the alleviation of the symptoms during an attack, and

the subsequent removal of the intra-nasal pathological condition, together with general medical treatment with a view to correct the abnormal action of the nerve-centres. My experience has shown that no other than a palliative treatment is indicated while the attack lasts, and any measure undertaken for the radical cure of the affection during that time will not only prove abortive, but aggravate the symptoms and increase the suffering of the patient.

The most relief is obtained, and in many cases the attacks are cut short, by frequent spraying of the nasal cavities with the antiseptic solution already mentioned, so as to remove all offending particles which may have gained access to the sensitive areas. After the mucous membrane has thus been cleansed a spray of a four per cent. solution of cocaine should be blown into the nostrils, and small pledgets of cotton, saturated with the cocaine solution, should be introduced between the septum and the swollen mucous membrane of the turbinated bones. The cocaine acts in contracting the bloodvessels, and in thus shrinking the turbinated tissue opens the respiratory portion of the nose, at the same time diminishing the exudation of serum, and in this way gives great relief, if only for a short time, to the sufferer. The cocaine solution should not be dropped into the nostrils, nor injected with a syringe, as in that case but a small portion of the nasal mucous membrane is acted upon by it; nor should the application be made oftener than two or three times a day, because the frequent contraction and expansion of the vessels, due to the drug, have the effect of causing a loss of tonicity, and the swelling of the turbin-

ated tissue is increased instead of being diminished. After the removal of the cotton pledgets, small pieces of fine surgical sponge, cut to fit closely, should be introduced into the nostrils, so as to filter the inspired air and keep all irritants out of the nasal cavities. These pieces of sponge should be worn day and night, and if kept clean by frequent washing do not in the least interfere with nasal respiration, and give great relief.

Internally, quinine, in large doses, tonics, and in the first stage atropia act well in reducing the febrile condition; while in the latter stages, when the asthma has set in, iodide of sodium, together with bromide of sodium in rather large doses (āā gr. x three times a day), gives marked relief. In some cases, particularly in those in which the neuralgic headache is very severe, morphia, hypodermically, is the only drug which will give relief from the intense suffering.

If a foreign body, rhinolith, or polypus is found in the nasal cavity, it should be removed at once; but it is worse than useless to treat a hypertrophic condition of the turbinated tissue. After the attack has subsided, however, all pathological conditions should be removed in the manner described in the foregoing chapters, and the sensitive areas should be destroyed with the galvano-cautery knife in the following manner:

The anterior nasal cavities having been well illuminated, a probe is introduced and its point is run over the surface of the mucous membrane. As soon as a sensitive spot is touched, it will show itself by causing an elevation of the surface throughout its

extent, and a deepening of the color as well as lachrymation of the eye on the same side. A flat galvano-cautery knife, heated to a cherry-red heat, is then quickly introduced and pressed against the sensitive area with its flat surface, thus destroying the superficial layer of the mucous membrane. Cocaine cannot well be used to anæsthetize the mucous membrane, because its depleting effect greatly interferes with the distinctness of the difference of color between the spot to be burned and the surrounding mucous membrane, so that it is difficult, if not impossible, to locate the sensitive area; nor is it necessary to use cocaine, as the operation is not painful, but can easily be borne by the patient without any anæsthesia. In most cases a large number of these spots are found on the surface of the septum and the middle turbinated bone, but not more than one should be operated on at one sitting. As soon as the resultant inflammation has subsided, which usually occurs in three or four days, another spot is to be cauterized, and this is to be repeated until all have been obliterated. Other caustics, such as chromic acid, acetic acid, or nitric acid, may be used for this purpose, but they are not as satisfactory as the galvano-cautery, because their effect cannot be limited as accurately. Under no circumstances should the healthy mucous membrane be cauterized; and the operator should be absolutely certain as to the location of the sensitive spot before applying the caustic. After this the case is to be treated, like one of ordinary hypertrophic catarrh, with the antiseptic spray and the iodine solution until all trace of chronic inflammation has disappeared.

Nerve tonics, and particularly dilute phosphoric acid, in ten-drop doses three times a day, should be given from time to time, as well as general treatment to correct any deviations from the general good health of the patient should be instituted, so as to produce a return to the normal condition of the vitiated nerve centres.

The length of time during which the local treatment should be continued varies in different cases, from a few weeks to many months, and in the case of hay-fever the general treatment should be kept up for at least two years. For, as a rule, the nerve-centres will not return to their normal condition in a few months, so that when the next hay-fever season after the treatment comes around the patient will, as a rule, have an attack, although very much modified in character as well as in duration, and it is only in the second or third season that entire immunity can be expected.

The cases of the rarer forms of vaso-motor coryzas usually yield much more readily to treatment, probably because the nerve-centres in them are not nearly so deeply impressed by the local irritation, and return more readily to their normal condition after the possibility of the local irritation has been done away with.

CHAPTER XVI.

ATROPHIC NASAL CATARRH.

THIS affection, which is popularly known as dry catarrh, may either be a sequence to the hypertrophic stage (and it is not uncommon to find hypertrophies in one side of the nose and an atrophic condition of the tissues in the other), or it may be of the atrophic variety from the start.

The symptoms complained of by the patient are chiefly great dryness of the nose and throat, with the occasional expulsion of large scabs of dried secretion, complete or partial loss of the sense of smell, and an offensive odor, not usually, however, perceived by the patient himself, but by his friends and all with whom he comes in contact. This odor, which has given rise to the term *ozæna*, by which this variety of catarrh is designated by many authors, is, however, also present in other affections, and may be noticed in cases of syphilitic ulceration of the nose, of caries, and in disease of the antrum, or it may be caused by the retention and putrefaction of the secretions in cases of foreign bodies in the nasal cavities, or when complete stenosis exists from malformation of the walls of the nose, and must, therefore, be looked upon as a symptom, and not as a distinct affection.

On inspection of the anterior nares, we find the mucous membrane everywhere dry and shiny, with

here and there brownish scabs of dried secretion adhering to it. The calibre of the nasal chambers is very much increased, and the turbinated bones are barely recognizable or altogether absent, so that nothing obstructs the view, and the wall of the pharynx can plainly be seen. Frequently erosions of the mucous membrane, especially on the septum, are seen when the scabs are removed, which lead to ulceration and perforation.

With the rhinoscope we observe the same withered condition of the mucous membrane in the naso-pharyngeal cavity, and particularly so on the pharyngeal wall, every trace of the glandular tissue or pharyngeal tonsil having disappeared. Large brownish crusts of dried secretion are here also seen, especially in the depressions at the margin of the mouth of the Eustachian tubes, and on the posterior aspect of the vomer, places where they cannot be easily dislodged by the ordinary methods of blowing the nose, or by hawking. The mucous membrane of the oral pharynx is also usually involved, presenting a dry, shiny appearance and is covered here and there with a grayish, tenacious mucus. This condition is described by many authors as a distinct disease, under the name of pharyngitis sicca, but is in reality merely an extension of the atrophic change of the nasal mucous membrane downward. Erosions and ulcerations are found beneath these scabs, which are often quite extensive, and may involve the periosteum of the vomer, thus producing necrosis.

Cause.—The causes of this variety of catarrh are essentially the same as those which produce the hypertrophic form, of which, in most cases, it is a

sequel. Syphilitic, scrofulous, or other specific taint of the system has, in my opinion, no direct influence upon the causation of this form of nasal catarrh. Although we find scrofulous patients who are suffering from atrophic nasal disease, this does not prove that the taint is the cause. The reason why certain individuals have hypertrophic and others atrophic catarrh, produced, apparently, by the same exciting causes, is a question not as yet satisfactorily settled.

Treatment.—The treatment must consist chiefly in keeping the nasal cavities clean, in preventing the formation of crusts, and in stimulating the mucous membrane, and those of the glands which have not been obliterated entirely by the process of atrophy. The cleansing is best effected by means of the post-nasal syringe and the spray in the hands of a physician, and the nasal douche used by the patient. The solutions should be alkaline, so as to dissolve the mucus more readily. It is best to use Dobell's or the alkaline antiseptic solutions with the post-nasal syringe, about three times a week, and to cleanse the nasal cavities thoroughly with it of all accumulations at each sitting. If ozæna is present, Listerine should be added to an alkaline solution in the following proportion:

℞ —Sodæ bicarb.
Sodæ bibor. āā ℥j.
Listerine, fl ℥j.
Aquæ, q. s. Oij.

This and the antiseptic solution are the only means of overcoming the fetid odor and making an examination of the nasal cavities possible without discomfort to the examiner. None of the other disinfectants, in

my experience, act as promptly and effectually as these solutions. If then any excoriations or ulcerations are seen, they should be touched with a sixty-grain solution of nitrate of silver, and if they are deep and extensive, it is best to char the surface with the galvano-cautery before using the silver. Dr. Bresgen, of Frankfort-on-Main, suggests the following formulæ, which are to be used successively as they lose their power of stimulation; they have proved very valuable in the treatment of this form of catarrh:

No. 1.	℞.—Arg. nit.	gr. $\frac{3}{4}$.
	Pulv. amyli,	gr. 154.
No. 2.	℞.—Arg. nit.	gr. $1\frac{1}{2}$.
	Pulv. amyli,	gr. 154.
No. 3.	℞.—Arg. nit.	gr. $2\frac{1}{3}$.
	Pulv. amyli,	gr. 154.
No. 4.	℞.—Arg. nit.	gr. $3\frac{4}{5}$.
	Pulv. amyli,	gr. 154.
No. 5.	℞.—Arg. nit.	gr. $7\frac{1}{2}$.
	Pulv. amyli,	gr. 154.
No. 6.	℞.—Arg. nit.	gr. 15.
	Pulv. amyli,	gr. 154.

These powders are applied in the following manner: After the nasal mucous membrane has been thoroughly cleansed from all thickened secretion by a spray of antiseptic solution or alkaline Listerine solution, a little of the powder is thrown into the anterior nasal cavities through the nostrils by means of the insufflator. Commencing with No. 1, the application is repeated every two or three days until the slight smarting caused by the particles of solid

nitrate of silver is not noticed, when No. 2 should be used, and so on.

Gottstein recommends a plug of cotton to be introduced into the nostril to take the place of the atrophied lower turbinated bone, with a view to diminish the calibre of the canal, and concentrate the current of air. This also acts beneficially, not for the reason stated, however, but because the cotton irritates and stimulates the mucous membrane, and by becoming saturated with the watery secretion, imparts to the inspired air sufficient moisture to prevent the drying of the secretions and the formation of scabs, thus materially relieving the dryness of the pharynx.

Other stimulants, such as myrrh, in powder or in the form of the tincture, sulphate of iron, quiniæ sulph., etc., and, above all, a moderately strong induced current of electricity may be applied locally with good results.

The general health should be looked after, and any predisposing causes removed if possible, while iodine, in the form of the iodide of potassium in small doses, and of iodide of iron, or cubebs, petroleum, Grindelia robusta, or any other drug which will stimulate the glands of the nasal mucous membrane, should be given internally. The petroleum seems to have a specific action upon the respiratory mucous membrane, and is best given in combination with Grindelia robusta. A formula which has given satisfaction is as follows:

℞.—Petroleum (crude) gr. ij.
Ext. grindelia robusta insp. gr. xv.
M.—Div. in pill No. 1.

To be filled in gelatine capsules.

With the best and most faithfully carried out treatment a cure cannot be effected in less than a year, and it often requires much more time than that, but most of the symptoms may be so ameliorated even in a short time as not to annoy the patient. This is especially true of the bad odor, which can be entirely relieved by thoroughly washing out the nasal cavities and removing all the collections of mucus. If, however, the odor persists after thorough cleansing, which happens in a few cases, then the disease must be looked for in the contiguous cavities, the antrum, the frontal sinuses, or sphenoidal cells, and these must be opened and washed out with disinfectant solutions in order to relieve the patient. As there is always more or less pain connected with disease of these cavities, which is localized, it is not difficult to locate the trouble in one of the other of these contiguous cavities.

When necrosis of either the vomer or of the turbinated bones is found, the surface must be thoroughly scraped, which is best done with the burr of the dental engine, as with the scraper the necessary pressure cannot be brought to bear upon the parts, and, furthermore, there is hardly enough room to use this instrument effectually. With the rapidly revolving burr, on the other hand, we both hear and feel at once when all diseased bone has been removed, and the tool comes in contact with the harder sound osseous tissue.

Syphilitic Catarrh.

Both the secondary and tertiary manifestations of syphilis are found in the nasal cavities as inflamma-

tion, gummata, and shallow or deep ulcerations, and present the same characteristics as in the pharynx and larynx. The destruction of tissue and loss of substance occasioned by the specific ulcerations are, however, as a rule, much more extended, owing to the close contiguity of the parts, and will often cause irreparable deformity of the nose by destruction of the septum. Perforation of the septum, in fact, is very frequently met with in this disease, but is not necessarily due to syphilis in all cases, for it is occasionally found in atrophic catarrh, and is said to be found invariably in workmen employed in bichromate of potash works. A bad odor, which is, however, different in character from the odor of atrophic catarrh and of disease of the contiguous cavities, always accompanies syphilitic ulceration of the nasal cavities.

The treatment is the same as that recommended in syphilitic laryngitis and pharyngitis, except perhaps that we can employ caustic applications more effectively in the nasal cavities than in the throat. In cases where gummata are situated on the septum so as to cause obstruction of the nasal cavities and prevent nasal respiration, as well as intense headache by pressure upon the nerve-ends, the action of internal medication is too slow, and surgical measures must be adopted to relieve the suffering of the patient. These growths, under such circumstances, should be scraped from the surface of the septum with a curette or sharp spoon, and the raw surface should be cauterized with a solution of acid nitrate of mercury (one to six). The operation is neither painful nor bloody when cocaine is used, and

no necrosis of the septum need be feared to follow, if such has not already taken place.

Lupus is occasionally found in the nose, and its manifestations are so much like those of syphilis that it becomes exceedingly difficult to recognize the disease. We find, however, usually an involvement of the skin, either at the time or soon after the disease shows itself in the nasal cavities, and this helps to confirm our diagnosis.

The treatment of this affection is described in detail in the text-books on diseases of the skin, and we need not here enter further into it, except to state that as a local application iodoform powder dusted over the ulcerated surfaces has given more satisfaction than any other topical application.

Tumors in the Nasal Cavities.

Tumors are also found in the anterior and posterior nasal cavities, and the laryngoscopist is frequently called upon to remove them.

Pathology.—Two varieties of nasal polyps are usually recognized, the mucous and the fibrous variety, to which I would add a third, the cystoid.

Like the hypertrophies of the mucous membrane and of the cartilaginous septum, these polyps are due to inflammation; and Galen recognized this fact, for Virchow quotes him as saying "that the nasal polyps are due either to inflammation or develop from a node or from germinal matter." And Virchow himself says that "on mucous surfaces tumors for the most part occur in places where there previously was a simple inflammatory disturbance

—where the simple inflammatory hyperplasia of chronic catarrh precedes the growth of polyps.

It is therefore evident that they may occur on any portion of the nasal mucous membrane, and that they will be found more usually in those portions of

Fig. 99.

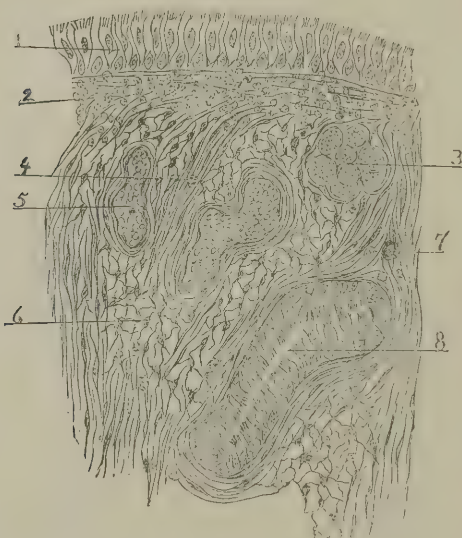
Vertical section through nasal cavity, showing nasal polypi.

the nasal cavities which are most exposed to the irritating influences of the air and dust, viz., in the respiratory portion. They are, however, also found in the antra of Highmore.

Under the microscope the mucous variety is seen to be composed chiefly of myxomatous tissue, which is intermingled with fibrous tissue and some organic

muscular fibres. Embedded in their substance we find some hypertrophied glands as well as venous sinuses, and sometimes we find in thin sections openings lined with columnar epithelium, which are probably the cross-sections of invaginated portions

Fig. 100.



Section of mucous polyp. × 300.

1. Epithelial layer. 2. Infiltrated submucous layer. 3. Mucous gland. 4. Fibrous band. 5. Venous sinus filled with blood. 6. Myxomatous tissue. 7. Transverse section of arteriole. 8. Invagination of mucous membrane.

of mucous membrane. The polyps are covered with ciliated columnar epithelium in those portions which are not exposed to the direct influences of the air, while the convexities pointing toward the nostrils are covered with stratified epithelium. Billroth

describes them as retaining all the elements of the mucous membrane, from which they spring. Occasionally we find that they have undergone telangiectatic degeneration.

The more rarely met with fibrous variety, which is very hard and of a glistening white color, stands in contrast to the soft, gelatinous, pinkish, and highly hygrometric mucous variety. Cornil and Ranvier say of the fibrous polyps: "They usually have their point of attachment in the posterior portion of the nasal cavity. They send prolongations in every direction, into all the cavities, either bending around obstacles or breaking through them, enlarging the nasal fossæ, thinning or destroying the bones, and penetrating by new ways or natural openings into the sinuses which surround the nasal fossæ."

Under the microscope they appear as true fibromata, containing, however, like the mucoid variety, glands, venous sinuses, and numerous capillaries. Both the fibrous and the mucoid variety of polyps are not infrequently combined in the same growth.

The question has arisen in my mind whether these growths should not be looked upon as simple hypertrophies of the mucous membrane which have undergone mucoid degeneration or fibrous change, or both, as the case may be, and this view is strengthened by the observations of Woakes, who describes as a primary stage of polyps, a granular-looking mass of hypertropied tissue covering the lower portion of the middle turbinated bone; for in this way the presence of glands, venous sinuses, and spaces lined with epithelium within their structure, can readily be explained, while, on the other hand,

the presence of these foreign elements cannot so easily be accounted for if we consider the polyps genuine neoplasms. Having once started in a localized hypertrophy of the mucous membrane, the mucoid or fibrous change rapidly assumes large proportions under the stimulus of continued irritation, pushing the mucous membrane before it; and in this way the often enormous pear-shaped masses are produced. I have frequently found a number of small mucoid polyps on the mucous membrane near the site of larger ones which I had previously removed, and which, if left undisturbed, would soon have filled the nasal cavity by their increase in size. This is a question, however, which cannot be determined by merely examining extracted polyps, but may possibly be settled by making sections through the mucous membrane at the point of origin of the tumors.

The third variety of polyps is a large sessile cyst filled with thin watery mucus and covered with epithelium. In the few cases which I have seen—too few to make extended examinations as to the nature of these growths—they sprang from the lower border of the inferior turbinated bone. I have not met with any mention of them in the literature to which I had access.

Symptoms.—The symptoms to which the presence of polyps gives rise, when situated in the anterior nasal cavities, are a stoppage of either one or both nostrils, so that the patient is obliged to breathe through his mouth. This stoppage of the nose is usually aggravated in damp weather on account of the swelling of the neoplasms due to the hygro-

metric condition of the atmosphere. Articulation is altered by the absence of those consonants whose articulation requires that a current of air should pass through the nose, and the patient speaks as if he had a cold in his head. Bleeding of the nose is a frequent symptom, and originates either from the tumor itself or from the congested mucous membrane in its neighborhood.

Tumors in the nasal cavities give rise to all the symptoms of nasal catarrh, and their presence is usually not suspected until a rhinoscopic examination is made, or until they appear in the nostrils.

These neoplasms are usually mucous or fibrous polypi, but other forms of tumors, such as have been enumerated as occurring in the larynx, are found.

Treatment.—The treatment of nasal polypi consists in their removal, and it becomes a question, which of the different methods is to be used to accomplish this purpose.

Before the introduction of the rhinoscope and the modern methods of inspecting the anterior nasal cavities, the surgeon made use of what is termed a polypus forceps, slightly curved, with elongated fenestrated blades, the inner surfaces of which are ribbed, to afford a better hold upon the polypus. These were introduced into the nostril, and coming in contact with anything that felt like a tumor or polypus, the blades were forcibly closed, the forceps twisted in the hand, and traction made until the growth came away, either in fragments or, more rarely, bodily. This was repeated until the cavity seemed clear of polypi, or until the patient could no longer endure the pain. This method even now

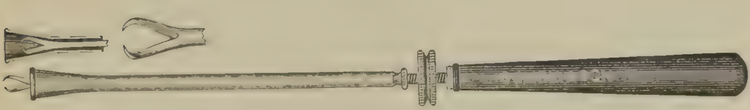
is practised by many surgeons, but it is, to say the least, unsatisfactory. In the first place, the forceps, not being guided by the eye, comes roughly in contact with the congested mucous membrane, injuring it and giving rise to hemorrhage; further, the pedicle of the tumor is but rarely removed, so that the polypus speedily grows again, or, if it comes away, a shred of the mucous membrane to which it adheres is also torn away, giving rise to a great deal of pain and considerable hemorrhage; and finally the irritation and injury of the mucous membrane give rise to considerable and extensive inflammation, which sometimes assumes alarming proportions.

Another method for the removal of nasal polypi has been recommended by some authors, which consists in injecting into their substance, by means of a hypodermic syringe, some solution of liquid, with a view to cause a mortification of the tissues of which the tumor is composed, such as glacial acetic acid, tincture of iodine, alcohol, etc. It will be found, however, that as a rule these injections give rise to so much pain that the patient is not willing to have them repeated on the other polypi; and if the solution is made so weak as not to give rise to much pain, the polypus is not affected by it.

The method which is preferable to any other, consists in removing the polypi with a wire snare in the following manner. The nostril being dilated with a dilator, the cavity brightly illuminated, and the mucous membrane anæsthetized with cocaine solution, the Jarvis' snare is introduced, and the loop manipulated so that the polypus in view is encircled by it, and slips through it. The wire should be of a

medium size, and the loop just large enough to take in the growth. The loop is then drawn in with the sliding tube, thereby causing it to slip around the pedicle, and when tight around it the tumor is snared off by turning the milled nut. In a few seconds the polypus will come out held at the end of the canula, and cut off close to the mucous membrane, without the latter being in the least torn or injured, and consequently very little pain is experienced by the patient, and little, if any, hemorrhage follows the operation. One after the other of the polypi is removed in the same manner until the cavity is clear, which takes some little time, as they are generally multiple and quite numerous. Having accomplished this, every bleeding point which was the seat of a polypus, should be carefully touched with a flat galvano-cautery knife at a cherry-red heat, in order to prevent a recurrence of the tumors.

FIG. 101.



Double hook.

Sometimes the growths are attached high up between the turbinated bones, so that it becomes impossible to throw the wire loop around the pedicle and remove them in this way. In such cases it is often possible to grasp the protruding end of the polyp with a pair of rat-tooth forceps, or, better still, with the double hook, or devil, and draw it down so that the wire loop can be thrown around it, and by manipulation caused to slip around the pedicle. This

double hook (Fig. 101), which I devised some years ago for this very purpose, consists of a thin steel shank set in a small wooden handle. The projecting end terminates in two small, sharp hooks bent in opposite directions, while the end near the handle has a screw thread cut on it, upon which a milled head runs easily up and down. The whole of the shank is covered by a metal canula, the lower end of which rests on the milled head, while the upper end has a bell-shaped expansion which, when the canula is pushed up, covers the hooks. In using this instrument the canula is pushed down so as to expose the hooks; these are pressed against the presenting portion of the polypus and the handle is slightly turned toward the right. This causes the hooks to enter the tissue and traction upon the instrument in a straight line will not release them. The canula is then pushed up against the polypus and held in position by the milled head, which is run up against its lower end. The instrument will then hang securely from the lower portion of the polypus without support, and the wire loop of the snare can be introduced around it and the polypus. If the instrument, which has been named a "Devil," is to be removed before the tumor or polypus is taken away, the milled head is run down and the handle is given a slight twist to the left, which causes the hooks to leave the tissue without tearing it. If the application of the devil is, however, not feasible, or if the wire loop cannot be laid around the pedicle of the polypus, forceps must be used; and it will be found that my universal laryngeal forceps answers the purpose better than the ordinary polypus forceps, because it can be

shaped into the required curve, and its blades can be opened in a much narrower space, thus grasping the polypus at or near the pedicle. When, in the case of fibrous polypi, the neoplasm has penetrated into the antrum, by absorbing the bony partition between the two cavities by pressure, it can, in most cases, be removed through the nasal cavity; but if it has its attachment in the antrum, and has forced its way into the nasal cavity, then the former must be opened in order to remove the growth.

If polypi or other tumors are attached to the walls of the pharyngeal cavity, or, as is sometimes the case, to the posterior edge of the vomer, they should also be removed with the wire snare in the same manner as was described for the removal of posterior hypertrophies.

The opening of the sac and emptying it of its contents, in the cystoid variety of polypus, affords relief from the symptoms of stenosis, but the cyst soon fills again, and, therefore, a more radical removal is necessary. To accomplish this, the cyst is opened in its entire length with a pair of scissors, and the flaps of tissue removed also with the scissors. The cut surfaces, as well as the remaining surface of the cyst, are then scorched with the galvano-cautery loop to prevent its re-formation.

Galvano-puncture.

There is another method of treatment for the removal of tumors, both in the larynx and in the nasal cavities, which frequently promises success where

the other methods already described cannot be employed, viz., galvano-puncture.

In this mode of operation the powerful chemical action of electricity is made use of in order to break up the tissues of the tumor and prepare them for speedy absorption. The procedure is a very simple one, and consists in the introduction of a needle into the substance of the neoplasm, to which is attached one of the poles of a battery, while the other pole is in contact with the skin in the neighborhood of the seat of the tumor. The battery need not be very strong, and for small tumors a single pint Bunsen cell is sufficient. The needle should be made of gold or silver, as steel is oxidized more readily by the electricity. From two to ten sittings are necessary to cause the absorption of a tumor the size of a pea in the larynx, while nasal polypi, especially of the mucous type, are often absorbed very much more quickly.

CHAPTER XVII.

TABLES OF SYMPTOMS OF THE DISEASES OF THE LARYNX AND NASO-PHARYNX.

The following tables of symptoms of the diseases of the larynx and naso-pharynx have been compiled from the carefully kept records of over five thousand cases, treated both at the German Throat Infirmary and at the dispensary for throat diseases of the University Hospital.

It will be observed that secondary and tertiary syphilitic throat diseases, which by many authors are separated, have been classed under one common head, because the symptoms are very similar in both forms.

It will be further noticed that only those diseases which are strictly affections of the throat have been included, while those which are to be regarded as symptoms of general systemic disorders have been omitted.

TABLE OF SYMPTOMS OF DISEASES OF THE LARYNX.

Symptoms.	Acute laryngitis.	Chronic laryngitis.	Tubercular laryngitis.	Syphilitic laryngitis.	Benign growths.	Malignant growths.	Functional diseases
SUBJECTIVE :							
Voice,	Hoarse, sometimes aphonic.	Hoarse ; faltering ; easily fatigued.	Hoarseness of peculiar character; aphonic in later stages.	Hoarse ; seldom aphonic.	Variable, from slight hoarseness to aphonia.	Variable.	Aphonic in bilateral paralysis. Hoarse in other forms of paralysis.
Respiration,	Not embarrassed except when œdema is present, then dyspnœa.	Not embarrassed.	Hurried, embarrassed in later stages.	Not usually embarrassed.	Embarrassment depends upon situation of growth.	Quickened and paroxysmal.	Embarrassed in paralysis of abductors.
Cough,	Dry and hard ; later moist.	Hacking, with starchy expectoration.	Painful ; amount and character depending upon the lung implication	Slight hacking.	Not severe ; occasional expectoration of parts of growth.	Not severe ; occasional expectoration of parts of growth	Paroxysmal in spasmodic affections.
Deglutition,	Usually painful.	Not interfered with.	Difficult and painful.	Unimpaired, unless epiglottis or arytenoids are ulcerated.	Impaired when growth is situated on epiglottis or ary-epiglottic fold.	Difficult and painful.	Not generally affected.
Pain,	Feeling of constriction and acute pain.	Feeling of fulness.	Only in deglutition and phonation.	Absent.	Absent.	Severe.	Not usually present.

Symptoms.	Acute laryngitis.	Chronic laryngitis.	Tubercular laryngitis.	Syphilitic laryngitis.	Benign growths.	Malignant growths.	Functional diseases.
PHYSICAL:							
Color,	Uniformly intense red.	Partially increased.	Grayish-red.	Dark-red in symmetrical patches.	Variable with nature of the growth.	Livid.	Normal.
Form and texture,	Swelling in œdema.	Abrasions.	Swelling of mucous membrane, ulcers, and pyriform swelling of arytenoid cartilages.	Ulcerations and specific neoplasms.	Variable; no ulcers.	Depends upon size and nature of the growth; large ulcers.	Form of glottis changed.
Position,	Unaltered.	Unaltered.	Usually no displacement.	Unaltered except when changed by cicatrices of ulcers.	Normal parts seldom changed.	Displacement by infiltration.	No displacement.
External,	Pharynx implicated.	Pharynx implicated.	Pharynx involved; physical signs of lung disease.	Pharynx, velum, and skin implicated.	None.	Glands implicated; cancerous cachexia.	Other organs may be affected.
CAUSE,	Exposure to draught. Embedded foreign bodies or corrosive substances.	Impure air; abuse of voice.	Same as of lung affection.	Primary sore.	Uncertain.	Primary cancer in other parts	Cerebral disease, hysteria, acute and choronic laryngitis.
PROGNOSIS,	Favorable except in œdema.	Favorable.	Unfavorable.	Favorable.	Depends upon size and position of growth	Unfavorable.	Favorable when cerebral disease is absent.

Table of Symptoms of Diseases of the Naso-pharynx.

Symptoms.	Acute pharyngitis.	Chronic pharyngitis.	Syphilitic pharyngitis.	Granular pharyngitis.	Tonsillitis.	Nasal polypi.	Nasal catarrh.
SUBJECTIVE:							
Voice,	Usually hoarse, with thick articulation.	Normal, unless larynx is implicated, then hoarse and easily fatigued	Normal, or slightly hoarse. Articulation nasal if velum or uvula is ulcerated.	Usually hoarse from laryngeal implication. Articulation normal.	Normal; articulation thick.	Normal; articulation nasal.	Normal; articulation more or less nasal.
Respiration,	Not interfered with except when tonsils are touching each other.	Not interfered with.	Not affected.	Not affected.	Affected only in severe cases.	Respiration through nose more or less obstructed.	Respiration through nose affected, especially in recumbent position.
Cough,	Hacking; later moist.	Dry, but slight, white stringy expectoration.	Variable.	Often severe and dry, with little expectoration.	Slight.	Absent.	Slight, with expectoration of thick tenacious mucus.
Deglutition,	Difficult and painful if tonsils and glands are implicated.	Not affected.	Difficult according to position of ulcers.	Not affected.	Almost impossible, and very painful.	Not affected.	Not affected.
Pain,	Severe lancinating.	Sense of dryness and burning.	Usually absent.	Sense of dryness and fulness.	Severe.	Usually absent.	Frontal headache, sense of dryness in nose and pharynx.

Symptoms.	Acute pharyngitis.	Chronic pharyngitis.	Syphilitic pharyngitis.	Granular pharyngitis.	Tonsillitis.	Nasal polypi.	Nasal catarrh.
PHYSICAL:							
Color,	General redness of mucous membrane.	Generally diminished with prominent veins.	Brick-red. Symmetrical patches.	Usually paler than normal.	Tonsils appear livid.	General hyperæmia of nasal mucous membrane.	Redder than normal.
Form and texture,	Not changed.	Mucous membrane dry and shining.	More or less deep ulcers on pharynx, velum, and tonsils.	Red nodules and prominent veins on surface of pharynx resembling granulation.	Great tumefaction of the glands.	Depends upon character of polypus.	Tumefaction of mucous membrane. Hypertrophies; shallow ulcers.
External,	Larynx implicated.	None.	Skin implicated.	None.	Implication of cervical and submaxillary glands.	Stoppage of nose; dryness of mouth and pharynx; bleeding from nose.	Stoppage of nose, often watery discharge; slight depression and widening of bridge of nose.
CAUSE,	Exposure to cold.	Bad air, alcoholism, masturbation.	Primary sore.	Abuse of voice; gastric derangement.	Exposure to cold.	Uncertain.	Vitiated air and changeable climate.
PROGNOSIS,	Favorable.	Favorable.	Favorable.	Favorable.	Favorable in most cases.	Favorable.	Favorable.

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